ANAMORPHIC ART

by Jurgis Baltrušaitis

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7

03/02/1960

et optique,et plaisir,ambassadeurs d'holbein,vide

10/02/1960

illusion et histoire de la peinture

08/06/1960

antigone et image de la passion;cylindre anamorphique de la tragédie

8

17/05/1961

beauté et chose

11

26/02/1964

construction optique,"les ambassadeurs",image et surface,perspective,phallus et érection

04/03/1964

et optique,"les ambassadeurs",et désir

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. . . there is nothing more perilous
than to arrive at madness through reason
Cornelius Agrippa

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Preface

In the history of art, perspective is generally considered to be a realistic factor, restoring the third dimension. But it is, above all, a device the nature of which varies according to the intentions behind the work. This book is concerned with its fantastic aspects, the absurd side of perspective.

Anamorphosis – a word that makes its appearance in the seventeenth century but for a device already known – plays havoc with elements and principles; instead of reducing forms to their visible limits, it projects them outside themselves and distorts them so that when viewed from a certain point they return to normal.[1] The system was established as a technical curiosity, but it embraces a poetry of abstraction, an effective mechanism for producing optical illusion and a philosophy of false reality. It is an enigma, a wonder, a marvel. Although it belongs to the world of curiosities which in the fund of human knowledge has always had its 'cabinet' – its private room – and refuge, it not infrequently spills over the hermetic framework of that domain. These scholarly 'games' are, by definition, something more.

The subject of this book is the history of pictures in which reality and appearance are artificially separated by artists and scholars. 'Accelerated' and 'decelerated' perspective systems upset a natural order but without destroying it. Anamorphic perspective destroys it by carrying the same principle to its logical extreme. Disintegrated pictures reconstituted by optical rays were commonly found in the sixteenth century. They were considered to be miracles of art and for some time the secret of how they were executed was jealously guarded, but subsequently they spread almost until our own time. The procedures for creating these compositions were revealed only step by step, and it is not until the seventeenth century that we see exhaustive demonstrations of them and of their relationship with other intellectual speculations.

Perspective has its place in the body of knowledge about the world. It is surrounded with legends and with theories about the universe. It is associated with certain automata that gave rise to notions about mechanisms governing forms of life. Anamorphosis renewed contact with the occult and at the same time with theories concerning the nature of doubt. It all led to discussion of the 'Vanities', culminating in Holbein's painting *The Ambassadors*, to which a chapter of this book is devoted.

A new instrument, the mirror, appeared in the anamorphic field around 1615–25. Stated in geometrical terms, it is the replacement of the visual angle by the angle of reflection. The gleaming mirror itself takes on magic powers by conjuring up phantoms. Chinese prestidigitation was grafted onto the 'catoptrics' (mirror anamorphoses) of Antiquity and the Middle Ages, thus reshaping methods that had been established for direct vision. For a long time conical and cylindrical viewing toys were to divert the connoisseur and the curious spectator alike.

In the eighteenth and nineteenth centuries, anamorphosis parted company with metaphysics and existed once again in its own right. Adopted both as a trick of the artists' trade and as a fashionable perversion, anamorphosis developed along lines established by the fantasies of the Renaissance. It is a continual reminder of the astonishing and artificial elements in perspective, whether it be optical distortion or striking *trompe-l'oeil*. Perspective ceases to be a science of reality and becomes an instrument for producing hallucinations.

Poets of our own time have meditated on these pictures in which nature and life pass through cataclysms to a mysterious rebirth. Frances de Dalmatie (1957) gives an anamorphic definition of poetry itself, with its perspectives lost in infinity and its images revealing themselves from a secret yet exact spot.[2] For Jean Cocteau (1961) it was in the corridors of a cylindrical anamorphosis, like the labyrinths of Knossos, that the 'no man's land' where poetry and science meet was situated.[3] This book deals with anamorphosis as a system with a basis of mathematics and physics around which figurative forms and mental speculations are made and unmade.

Anamorphoses ou Perspectives curieuses was first published by Oliver Perrin in 1955. A second edition was published in 1969 with a different subtitle: *Anamorphoses ou magie artificielle des effets merveilleux*. This edition was enlarged both in its documentation and in its treatment of specific problems. In addition it included the section on catoptrics which was being considered for separate publication at the time of the first edition. The subtitles of the first and second editions are both taken from Niceron's *La Perspective curieuse ou magic artificielle des effets merveilleux* (Paris 1638). This translation is from the second edition and incorporates some new corrections and additions made by the author.

CHAPTER ONE
Accelerated or decelerated perspective

The difference between the intrinsic nature of an object and our perception of it has fascinated philosophers and artists of all times. Plato in *The Sophist* distinguishes two arts of imitation: the art of copying, reproducing forms exactly, and the art of evocation, transposing them into the world of appearances.[1] The great works of sculpture or painting appear other than what they are: the upper portions too small, the lower too large. Thus handsome figures are no longer so if their true proportions are reproduced. In order to keep them handsome, artists with scant respect for the truth endow them, not with the forms they actually possess, but with those they judge most felicitous. It is no longer a question of reality but of fiction. 'Works which, considered from a favourable viewing-point, resemble the beautiful but which, properly examined, no longer offer the resemblance they promised, are phantoms.' And the art responsible for them is nothing but a phantasmagoria.

The Roman architect Vitruvius echoed this reasoning and drew practical conclusions from it.[2] Since what is true appears false and things seem different from what they are, in representing them we must add or subtract. In the case of an architectural façade, this involves replacing straight lines by curves, thickening, raising, and inclining certain parts. Columns swell in the middle, their bases bulge, corner columns swell (by a fiftieth part of their diameter), architraves lean forward (by a twelfth part of their height).[3]

Of course, these are only minor adjustments 'to remedy errors of vision', but it is the same principle of deforming natural forms, of obtaining equality through inequality and stability through instability. Architecture thus conceived is not strict reality but a Platonic phantom.

For Vitruvius the image created by the object changed according to the density of the air, the intensity of the light and other optical phenomena whose effects are only empirically registered. But his explanations had fallen behind the scientific knowledge of the time.[4] The laws of vision had been established geometrically by Euclid for more than two centuries. Perception is defined not only by atmospheric conditions but – and above all – by visual rays. As they emerge from the eyes the rays spread in a straight line and form a cone, the summit of which is in the pupil and the base the outline of the object.[5] Things increase or diminish according to

the width of the angle that contains them (axioms V, VI and VII).[6] 'In consequence there are common points where equal sizes seem unequal' and conversely (see theorems XLVIII and XLIV), and it is by calculating the proportions with the help of the rays that the desired results are obtained. A whole technique of phantom forms is embraced by this law. The perspective of dreamers distorting the truth is built up, paradoxically, by the system which describes it.

Perspective was to continue to develop in this ambivalent way. It is a science which fixes the exact dimensions and positions of objects in space, but it is also an art of illusion which recreates them. Its history is not only the history of artistic realism but the history of a dream.

Two phases should be distinguished after the end of the Græco-Roman world: the abandonment and disintegration of the basic principles of perspective, and their reconstitution by various means, leading to a complex doctrine of remarkable precision. Neglected for a long period by artists, all the problems of perspective were systematically tackled again, at first by scientists.

During the Middle Ages the sciences of Antiquity were passed on through Islam. The Treatise of Alhazen (d. 1039) had wide repercussions, and even the Latin translation of Euclid was made not from the Greek but from the Arabic, by Adelard of Bath in the twelfth century. Robert Grosseteste, Bishop of Lincoln (1175–1253), Roger Bacon (c. 1270), Vitellion (c. 1270), John Peckham, Archbishop of Canterbury (c. 1280), dealt with problems of perspective based on Islamic systems. By a curious contradiction, it was the culture most hostile to vision in depth and in relief in painting and decoration that taught its principles. There was a clear division between the optical experiments of artists and scientific speculations. This clear separation was to be maintained in the Gothic West, and the first researches of artists in the realm of perspective were empirical and wholly independent. In the process of clarification in the fourteenth century, research was pursued along the same lines in the Northern Schools until a relatively late date.[7] The meeting between the arts and sciences in fact took place in Italy in the first half of the fifteenth century (Ghiberti, Alberti).[8] It produced a wonderful flowering: Piero della Francesca (1469), Leonardo da Vinci (1492), Jean Pélerin, called Viator (1505), Dürer (1525), Vignola (1530–40), Serlio (1545), Barbaro (1559), Cousin (1560), all of whom applied mathematical theories methodically and elaborated procedures for dealing with all possible forms.[9] All the works that followed them exploited the knowledge accrued during the Renaissance.

Perspective was restored both as a rationalisation of vision and as an objective reality while at the same time preserving the element of make-believe. The development of its technique supplied new methods with every device. The illusion of infinite expanse could be created in a small space. Distances could be diminished. The possession of methods for producing exact representation led to the 'Great Illusion' – the multiplying of artificial worlds – which has haunted men of every age. F. Clerici gave some idea of its diversity and power in a learned anthology.[10]

A vast apse was simulated by Bramante at San Satiro in Milan (1514) in a space no deeper than 1.20 metres.[11] The accelerated foreshortenings of the cornice,

coffered ceiling and pilasters in stucco and terracotta give the impression of a vaulted room, but if one tries to enter one collides with a wall. The whole church is disturbed by this *trompe-l'oeil*, and everything is called into question.

The history of theatrical scenery is dominated in the sixteenth century by the problem of creating this illusion of distance.[12] The impression can be obtained not only by the abrupt contraction of the side walls but also by raising the horizon. The world in which reality and fiction finally intermingle was being progressively built up.

In Serlio's interpretation (1545) – repeated by Barbaro (1559) – of the staging for tragedy, comedy and satire described by Vitruvius, there is still a juxtaposition of real space – flat proscenium – and of illusory space – the inclined back of the stage, with the two oblique sides accelerating the perspective to a point where the space becomes too narrow for the actors to enter.[13] In the Olympic Theatre of Vicenza (Palladio and Scamozzi, 1580-5), with the tentacles of the sloping permanent décor forming seven streets in stuccoed wood opening onto the *frons-scenae*, the frontier is blurred.[14] All the architectural details, as in Bramante's Milan apse, are contracted, thus accentuating the effect of flight. Real and illusory space inter-communicate directly. These spaces were soon to fuse into one, because of the extension onto the proscenium, first of the oblique walls (Theatre of Sabbioneta by Scamozzi, 1588–9), then of the slope. In Sirigatti's treatise on perspective (1596), the whole stage is inclined.[15] The actors no longer move in a realistic environment, they exist in the realms of illusion. The stages of Furttenbach (c. 1625), Sabbattini (1637) and Troili (1672) (fig. 1) adopt the same principle of accelerated perspective.[16]

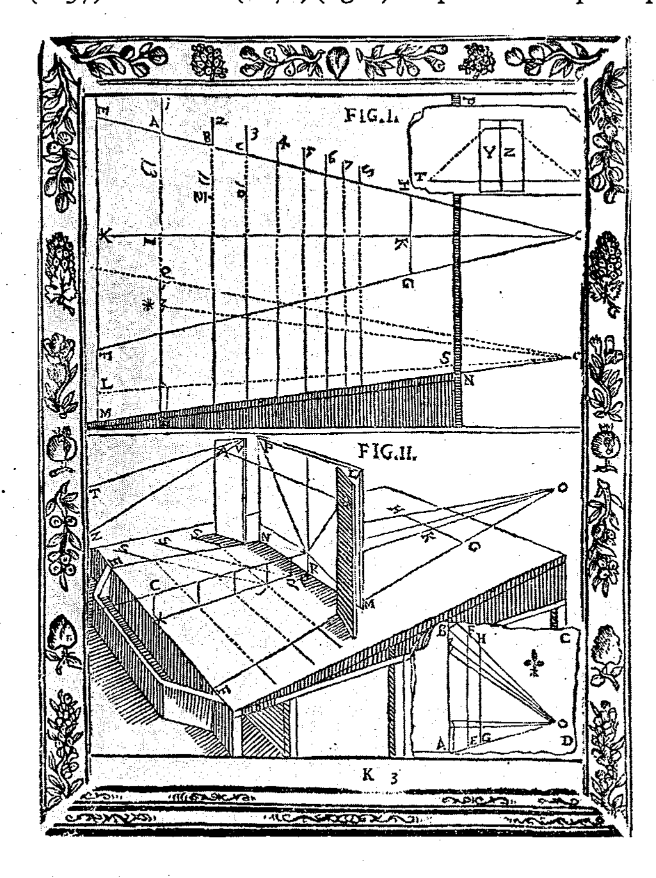


FIG. 1 Accelerated perspective: Troili's stage, 1672

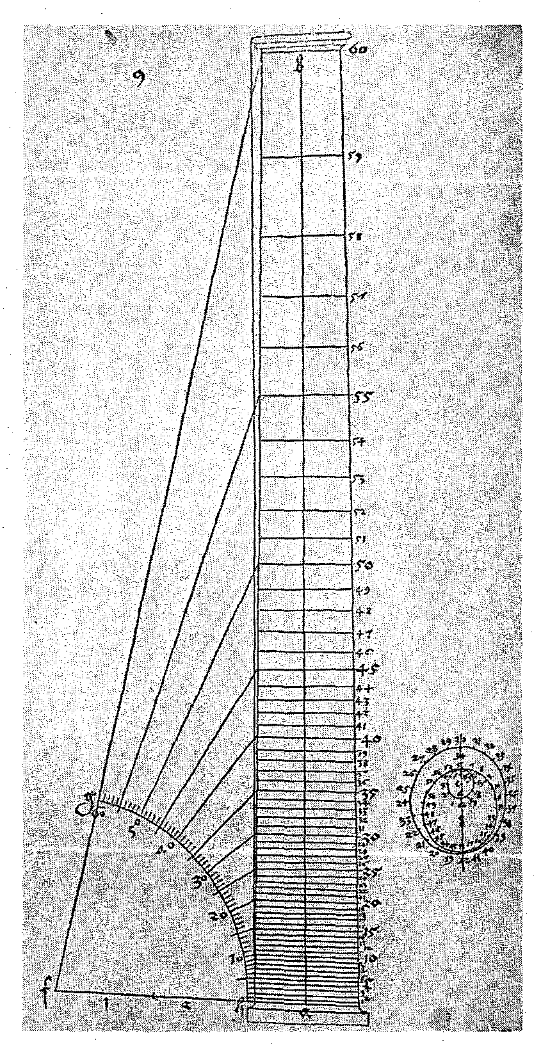


FIG. 2 Decelerated perspective: optical corrections for a straight column. Dürer, 1525

FIG. 3 Decelerated perspective: optical correction for a twisted column. Dürer, 1525

It would be worthwhile to try to discover whether similar arrangements were also made in gardens and even in architectural compositions on irregular sites. Theatre and life were continually intermingling at this period, and some building arrangements were directly borrowed from the theatre. The colonnade of the Villa Spada in Rome (c. 1638), built by Francesco Borromini, only some 8 metres long, creates the illusion of a long tunnel, by violently contracting the dimensions: 5.80 metres by 3.50 metres at the entrance, 2.45 metres by 1 metre at the exit, but without modifying the design of the component parts.[17] The accelerated perspective of a street on the stage of the Olympic Theatre at Vicenza is introduced into the décor of buildings by an abridged and steeper angle. No doubt we are witnessing fantasy playing with paradox, but it reflects the phantasmagorical conception of an architectural order.

The reverse process, decelerating perspective, that is, making objects appear nearer than they are by increasing the dimensions of distant elements, is taught methodically in treatises on perspective. Dürer (1525), explains it in the case of columns and letters (figs. 2 and 3), Serlio (1545), explains it for masonry.[18] It is not a matter, as with Vitruvius, of emphasising certain points. The linear vertical segments subtended by equal arcs, increase proportionately until, at the top, they

have increased tenfold. The courses of a wall increase proportionately as they rise. The decorations are elongated. Spirals of twisted columns lengthen five-fold at their third turn. From below, however, everything appears to be equal in size, since the angle of vision remains constant. The visual ray is not the passive conductor of a sensation produced by an object. It recreates it, giving realism to distorted forms.

An ancient building, the Temple of Priene, dedicated by Alexander to Athena Polias (335 B.C.), had, even at this early date, an engraved inscription with enlarged letters in the upper lines, in accordance with the Euclidean angle, but the system does not interfere with the proportions of the whole.[19] This is not the case in drawings of the sixteenth century in which, through the shifting of the viewing point towards its object, the power of the projection is concentrated for the sake of the clarity of the demonstration. The closer and lower the viewing point to the object, the greater the slant of the visual rays and the extension of the gradations which they mark on the vertical elevation. This results in incredible proportions. Restored in its full rigour, the antique procedure destroyed an order of Antiquity.

A drawing of the method of decelerated perspective is reproduced by Polienus (1628), that for lettering by Salomon de Caus (1612) and by Mydorge (1630).[20] The *Paradoxes of Perspective* by Troili (1672) proposed the application of the same rule, based on Serlio and Dürer, for the courses of walls, for inscriptions, for windows, and for statues set at different heights (fig. 4).[21] Decelerated perspective, acting as a brake on the vanishing point by the proportionate increase of dimensions, is applied to the façade and to sculptured décor. Two well-known legends

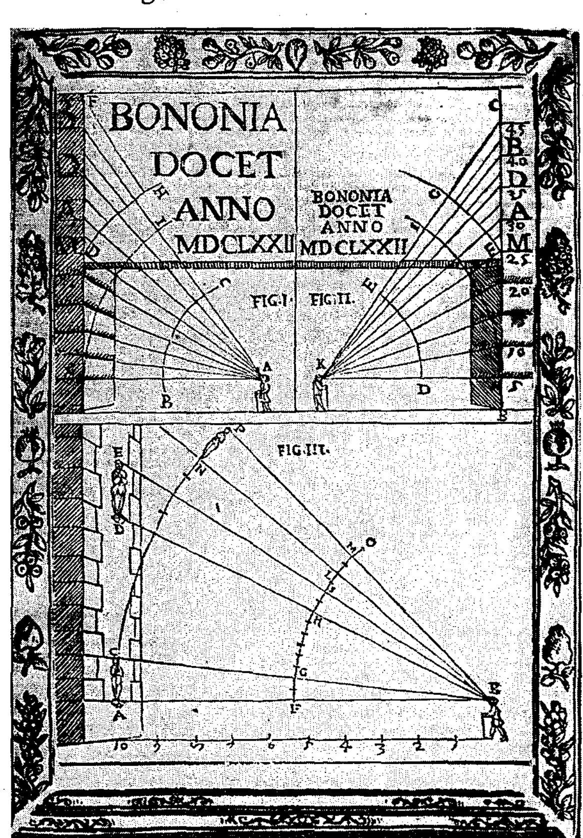


FIG. 4 Decelerated perspective: optical correction for lettering, architecture and statues. Troili, 1672

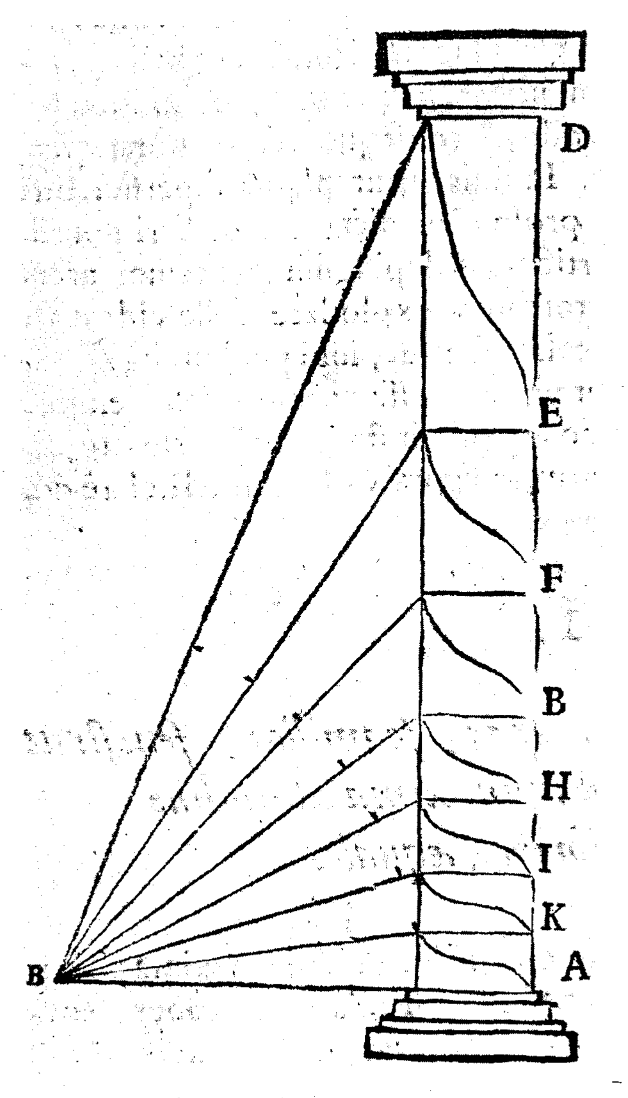
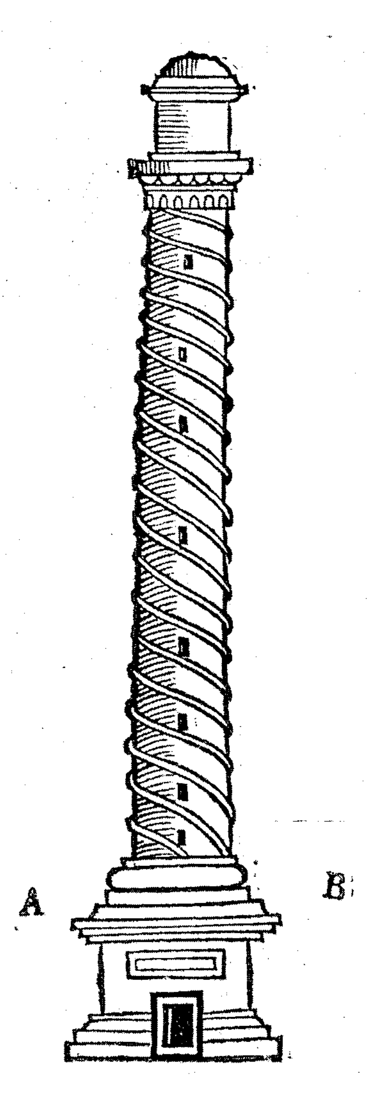


Fig. 5 Trajan's Column, Rome:
a. After Athanasius Kircher, 1649
b. After Bernardino Baldi, 1612

are connected with this technique: an anecdote about Phidias and a fantasy about Trajan's Column.

At the time of a competition for a statue of Minerva destined to crown a high pillar, Alcamenes carved a well-proportioned figure, whereas Phidias created one with distorted limbs, a gaping mouth and an elongated nose. On the day of the exhibition, Alcamenes won all the votes, whereas his rival was harshly criticised. But when the sculptures were set up in turn on the top of the column, Phidias's statue assumed great beauty whilst the rival work became an object of ridicule. The story is taken from Pliny by J.-F. Niceron (1638) and from Tzetzes, a Byzantine writer of the twelfth century, by A. Kircher (1646).[22] This legend of forms that must be distorted in order to recreate the beauty of the model therefore owes its survival to two sources. In Kircher the story is followed by technical explanations and the method of making 'the figures proportionately larger as they are diminished by the height of their situation', described by Lomazzo (1584), is now illustrated by a drawing after Dürer, showing the projection of the visual rays onto a column.[23] The drawing is a modification of Trajan's Column, considered from the sixteenth century as an optical wonder (fig. 5a and b). The column is completely



distorted. Instead of the twenty-five spirals of the twisted column, the frieze has only seven, and the width of the segments increases so rapidly that the final turn of the spiral occupies more than a third of the shaft.

Kircher's example is repeated by R.-F. de Chantelou (1663).[24] Commenting on Euclidean perspective, he refers to Trajan's Column as producing an admirable effect in which 'Art, supplementing Nature's error, causes the distant parts to be as discernible to the eye as the nearest', this effect being achieved by widening the intervals, thereby regaining 'precisely the same dimensions as the distance caused them to lose'. In fact, thanks to Girardon's measurements, it was already known that the distance between the spirals of the frieze was identical from the bottom to the top.[25] The Euclidean angle does not only distort antique proportions through an excess of zeal to prove a point; it creates a false notion of a monument that still stands in Rome.

The Trajan's Column myth is found again in Troili, according to whom decelerated perspective was used by all the best artists up to his time. Painters, sculptors, architects, he claimed, used it regularly: Galbert (?) among the ancient painters, Callot, Algardo among the modern masters. *The Last Judgement* in the



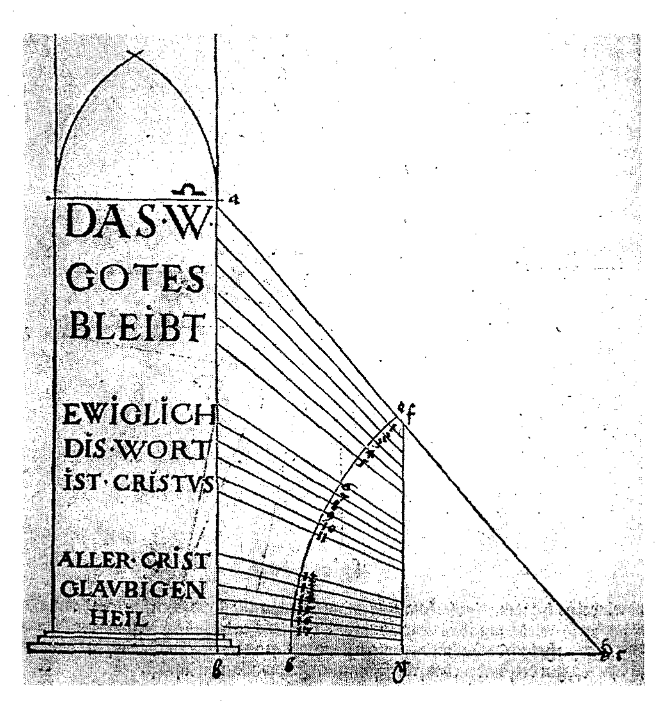


FIG. 6 Decelerated perspective:
a. Michelangelo *The Last Judgement*, Sistine Chapel, Rome, 1535–41
b. Lettering on a wall. Dürer, 1525

Sistine Chapel was also conceived in this manner.

As far as Michelangelo's composition is concerned (fig. 6a), Troili's claim is perfectly true. The three horizontal rows, the earth, the intermediate zone, the sky, become progressively larger. The final row even overlaps the cornices of the side walls, fixing the scale of the lower panels. It is a dynamic ensemble which rises to a climax as if a cosmic cataclysm was let loose.[26] But its vigour is not the result of improvisation. If one stands in the axis in front of the steps of the podium, the level of each row corresponds exactly to the same angle of vision. The method is like the one Albrecht Dürer used for wall inscriptions, similarly divided into three superimposed sections (fig. 6b). As with Dürer's letters, the participants in the scene become larger or smaller according to their position in the composition. Charon, at the base, is half the height of Christ and the saints and prophets at the top. Their respective dimensions are calculated like those of the letters, which, from a given point, appear equal in size and remain legible despite their distance from each other.

But the device works only up to a certain distance. If one looks at the fresco from a greater distance, its exuberance is no longer restrained by optical foreshortenings, and the vision bursts upon one. Increasing in size as they mount higher, the forms acquire a new majesty and fullness. The upper row is inhabited by Titans. The decelerated perspective produces overwhelming revelations and surging rhythms. An art which strikes us and is expressed by distortion is thus defined in a technique that restores true appearances by modifying the truth. Born as a result of a rational and organic development, art discovers new means and appropriates them. The excesses to be noted in some examples of the Baroque demonstrate the repercussions of such influence.[27]

Accelerated and decelerated perspective distort nature and at the same time transfigure it. But the gulf between reality and the way we perceive it leads also to a permanent separation.

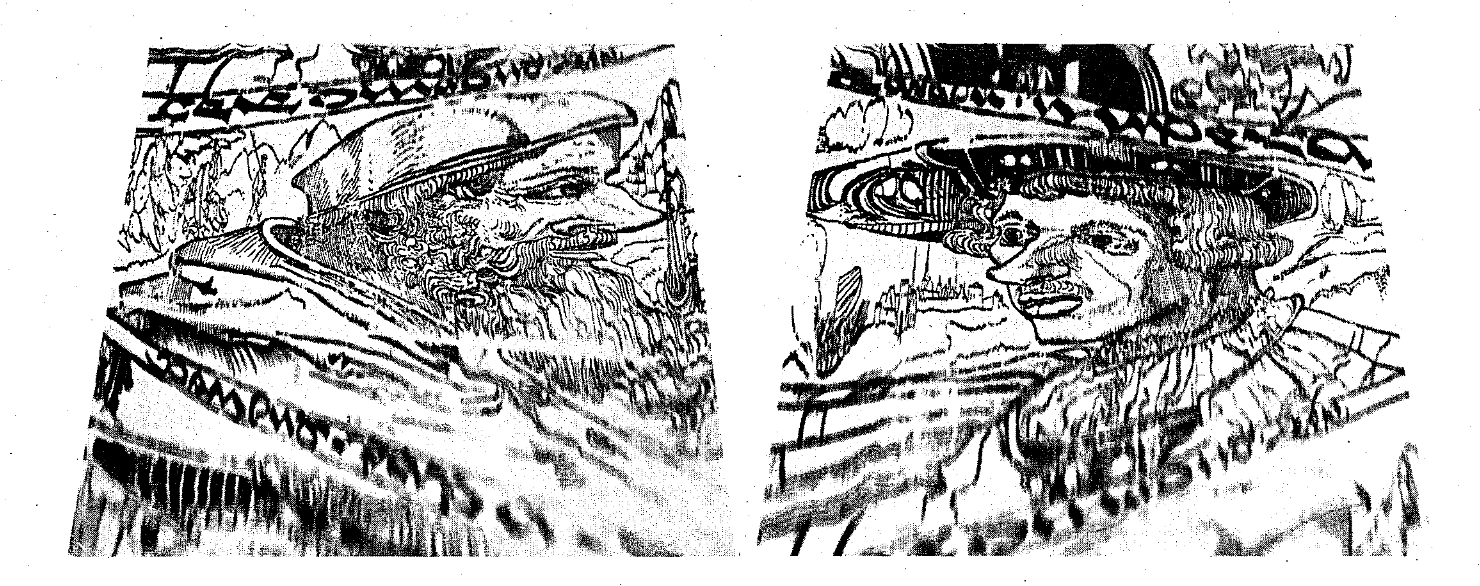
CHAPTER TWO
The first anamorphoses and their dissemination: sixteenth and seventeenth centuries

Among the fantastic systems associated with the genesis of modern Surrealist art are strange pictures which, seen from the front, present a confusion of elongated, apparently meaningless forms, but which, looked at obliquely, contract and form normal images. The Georges Hugnet catalogue, published on the occasion of an exhibition in New York, has three examples: an engraving by Erhard Schön and two panels by an unknown painter, belonging to the late Jacques Lipchitz, obviously executed at about the same date in the sixteenth century.[1] Contemporary artists have been intrigued by these pictures in which the subjects emerge and disappear as if by magic. Art historians have for the most part classed them as curiosities of no general importance.

A *Vexierbild* (puzzle-picture) by Schön, a Nuremberg engraver and pupil of Dürer, has been described by Röttinger: of large dimensions (0·44 metre × 0·75 metre) it is formed of four trapezoidal rows in which striped hatchings are continued by landscapes peopled with living figures.[2] Towns and hills, men and animals are reabsorbed and engulfed in a tangle of lines, at first sight inexplicable. But by placing the eyes at the side and very close to the engraving one can see four superimposed heads inside rectilinear frames.[3] Perspective causes the apparent images to disappear and at the same time the hidden outlines to appear. The human figures are perfectly identifiable: the Emperor Charles V, Ferdinand I of Austria, Francis I and Pope Clement VII. German and Latin inscriptions which are executed in the same way give their names. Clear, precise profiles emerge from linear chaos.

While preserving a thematic unity, the design combines two different pictures in one. The background which unfolds behind the hidden sovereigns recalls events connected with them and provides a key for deciphering their enigma: behind Charles V – a military scene, horses led by soldiers; behind Ferdinand I – the siege of Vienna (1529–32), often represented by Schön; behind the Pope – God threatening a Turk, and an armed ship; behind Francis I – Orientals and a camel, an allusion to his relations with the Turks.

This superimposition causes a disconcerting phenomenon which takes on a symbolic meaning. The features of the hidden royal effiges disturb the topographical sites. They hover over countries and over scenes of historical vicissitudes



like phantoms covering vast tracts of land. The vision takes place in an agitated landscape, marked by the sovereign power which it conceals. It is at once a drama and a piece of witchcraft.

Schön's woodcut must have been executed between 1531 (Ferdinand I was king) and 1534 (death of Clement VII), but a second version depicting another Pope, Paul III, in which the inscriptions are only in Latin (fig. 7a and b) also exists. This is the one in the Hugnet catalogue.

Two other engravings, originally attributed to Stefan Hammer, a Nuremberg publisher, are now ascribed to Schön.[4] Bartsch describes the succession of effects:

> 1. A very large piece showing on the left Jonah coming out of the whale. All the rest of the print is filled with apparently meaningless scribble, but which, viewed obliquely, with the eye practically on a level with the picture, shows a man satisfying his needs and this inscription: WAS SIEHST DU, 1538, STEFAN HAMMER ZU NURNBERG [fig. 8]. 2. Another similar piece which on the left shows a shameless woman surreptitiously passing to her lover the money she is stealing from the purse of an old man who is caressing her. All the rest of the piece is similarly filled with scribble, which, foreshortened, shows a very lewd scene and these words: AUS, DU ALTER TOR [fig. 9].

The above description is incomplete. Other scenes unfold around the confusion of elongated figures: in the first engraving a whale hunt, in the second a stag chase, and a boat with musicians – but all vanishes when the secret pictures appear.

Thus we know of four designs by Schön, executed during the years 1531–3 to 1538, in which these optical devices were used. The artist seems to have had a liking for and to have excelled in these contrived effects.

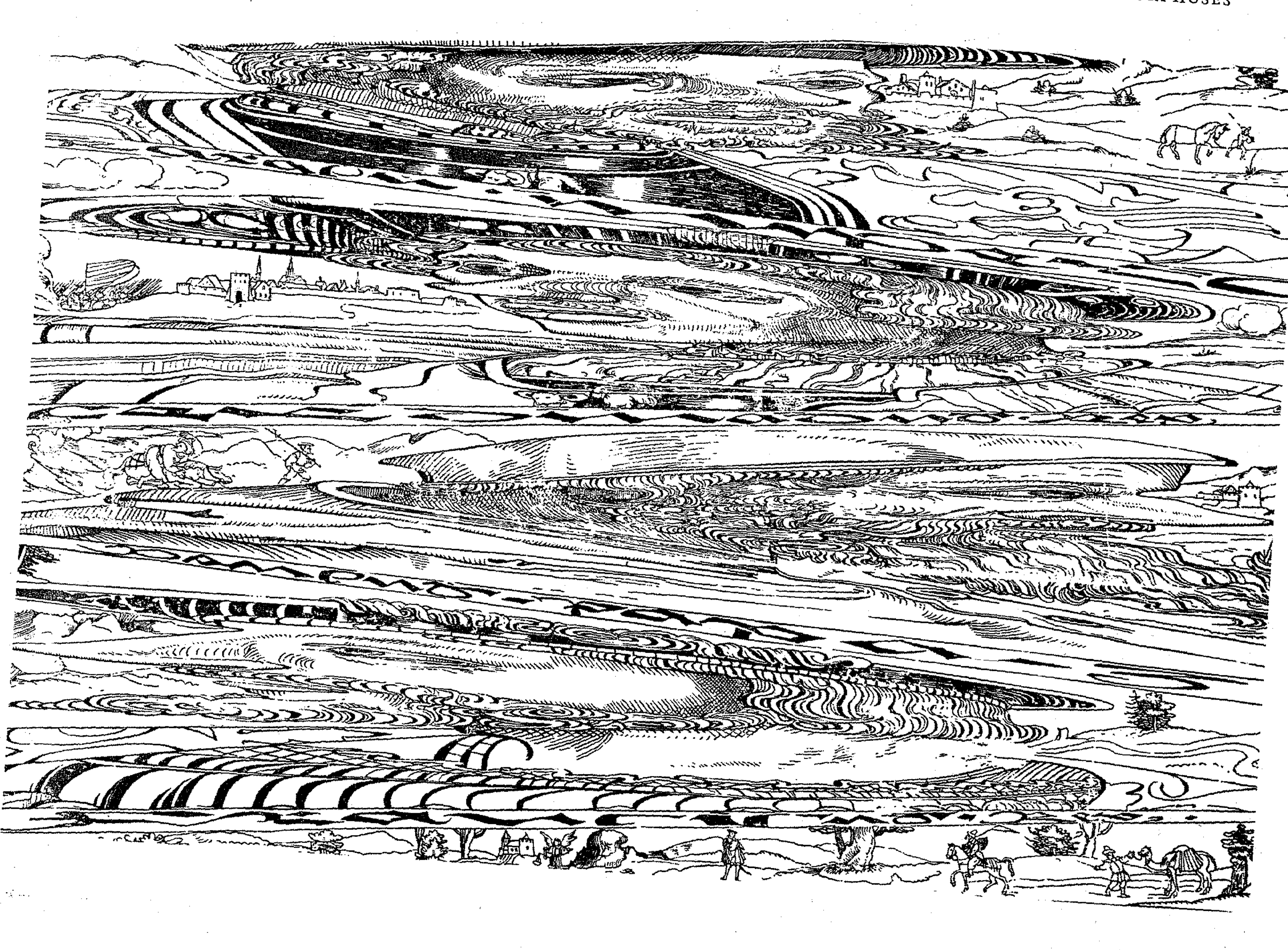


FIG. 7 *Vexierbild* by Erhard Schön:
a. The corrected portraits of Pope Paul III, and Ferdinand I
b. Anamorphic picture of Charles V, Ferdinand I, Pope Paul III and Francis I, c. 1535

FIG. 8 *Vexierbild* by Erhard Schön
'*Was siehst du?*', 1538 ('What do you see?')

FIG. 9 *Vexierbild* by Erhard Schön: '*Aus, du alter Tor !*' ('Out, you old fool!)

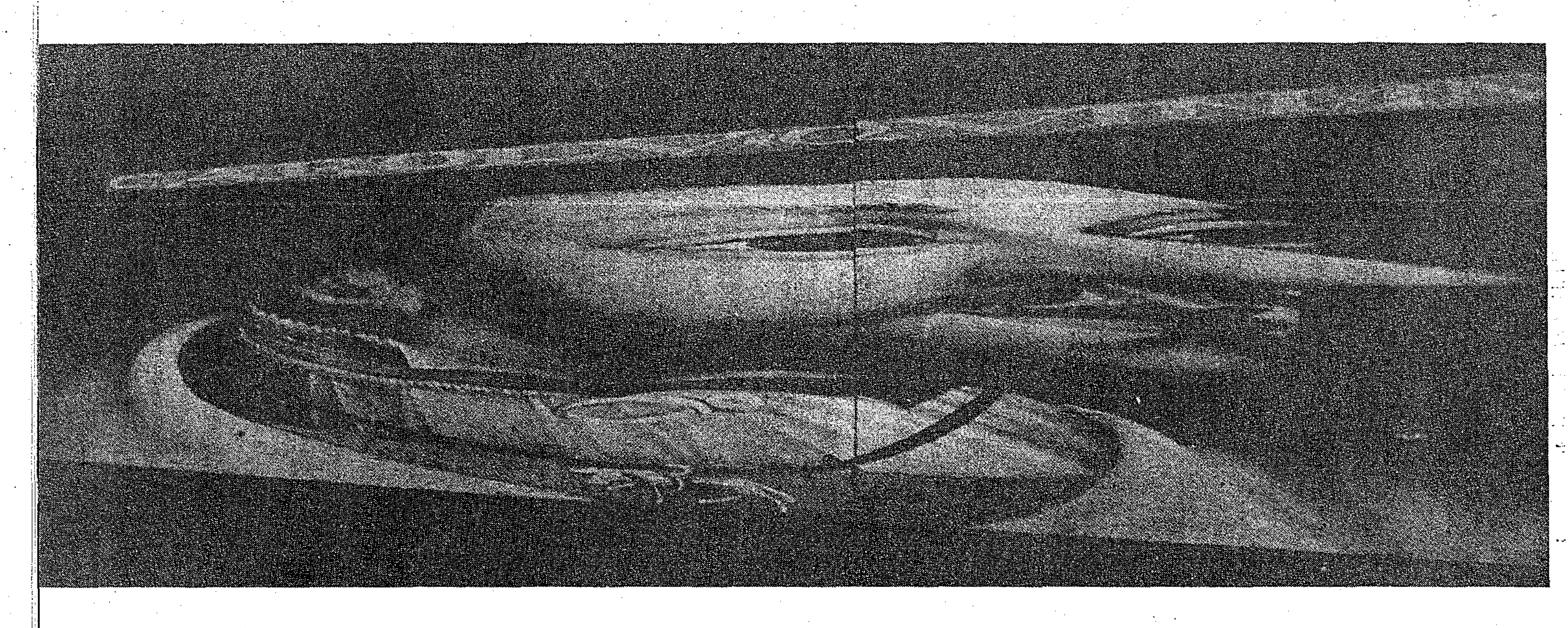


FIG. 10 Anamorphic portrait of Charles V, 1533. Lipchitz Collection, New York

The method is also employed in painting. One of the panels in the Lipchitz Collection depicts Charles V (fig. 10). The portrayal is similar to that of Schön in his first two plates. The emperor is shown from three-quarter view with the same design of the collar and insignia of the Golden Fleece. The inscription which gives his name (CAROLUS QUIN. IMP.) and his motto PLUS OUTRE also bears the date 1533, close in time to the first version of Schön's woodcut. A similar portrait of Charles V in Palencia Cathedral is mentioned by Louis Dimier.[5] This sovereign is frequently represented in these compositions, and we may well wonder whether it was in a milieu more or less attached to his person or to his court that they were first propagated with the greatest enthusiasm, at any rate among Germanic artists.

There is also an anamorphic portrait of a king of England, Edward VI, executed in 1546, the year before his accession to the throne (fig. 11). Paul Hentzner, a German traveller, who had seen it at Whitehall in 1598 described it: 'A picture of King Edward VI representing at first sight something quite deformed, till by looking through a small hole in the cover, which is put over it, you see it in its true proportions.'[6] The portrait is enclosed within a frame like a box, with a small hollow on the right side fixing the position from which the eye sees it correctly. Horace Walpole, who made out the now vanished inscription *Guiliemus pinxit*, attributed it to Marc Willems, an Antwerp painter and a pupil of Michel I. Coxie.[7] Wornum read the signature as that of Guillim Stretes, possibly of Dutch origin.

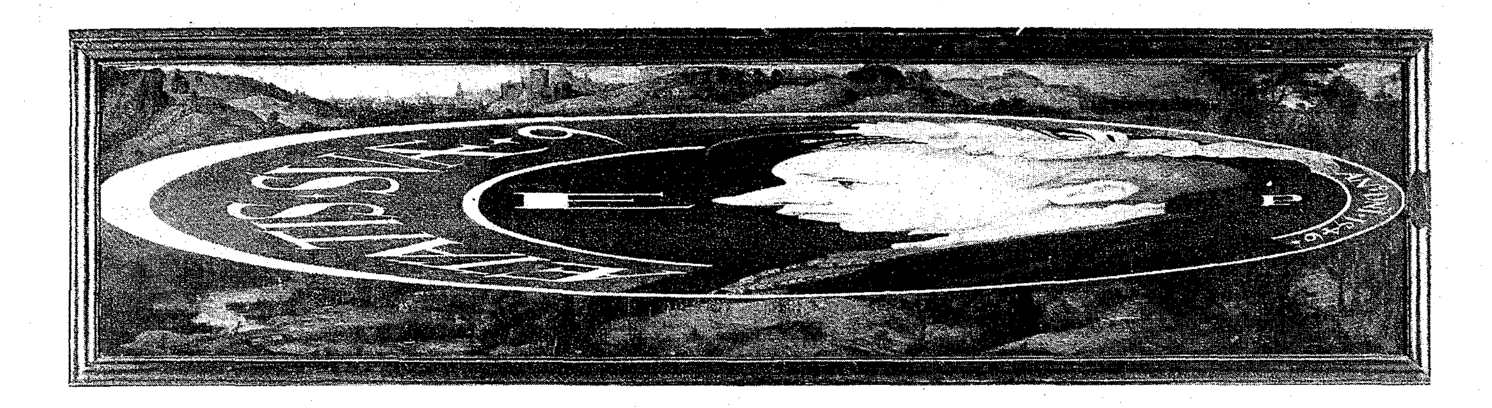




FIG. 11 Anamorphic portrait of Edward VI, 1546. National Portrait Gallery, London

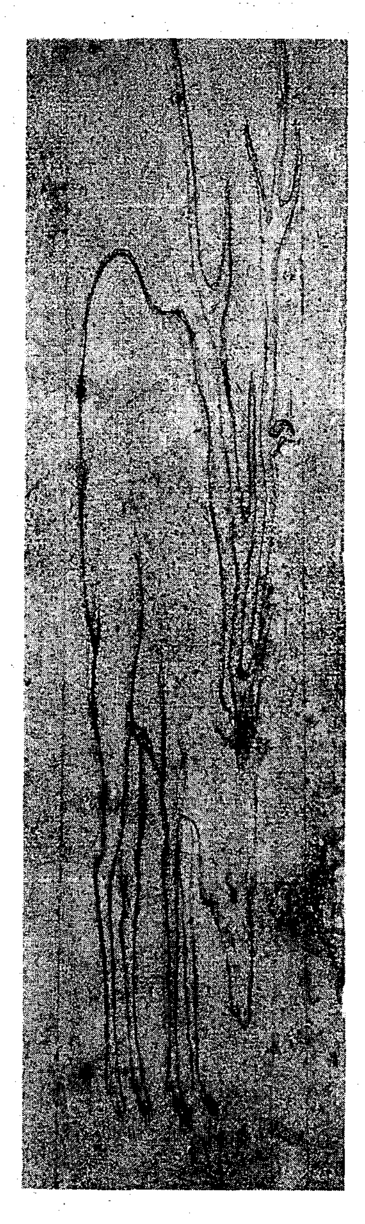
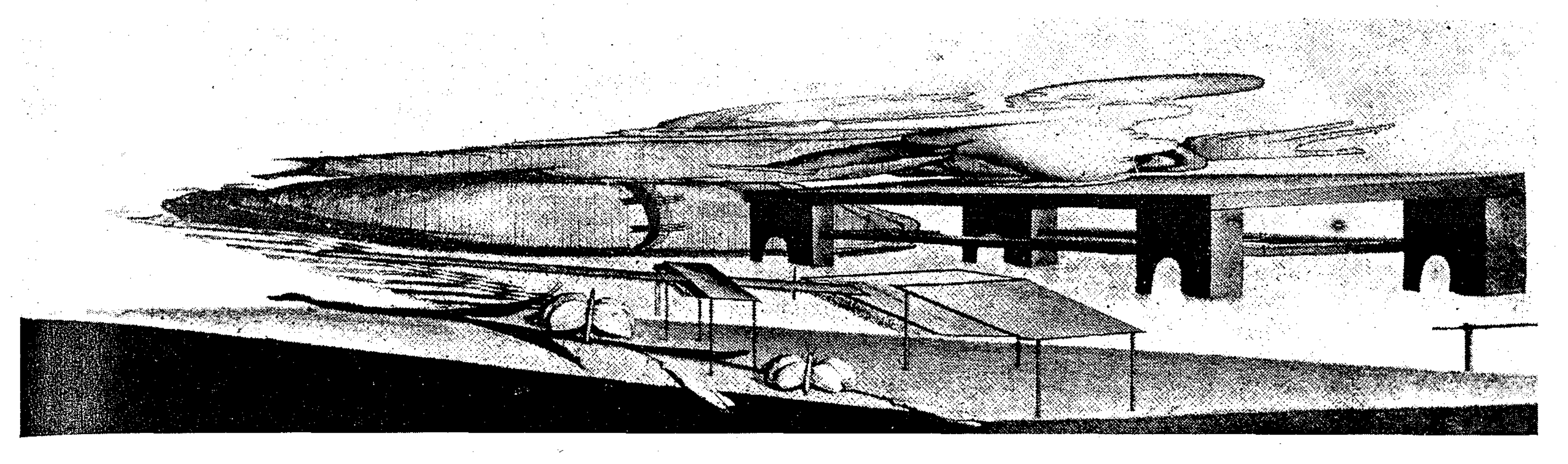


FIG. 12 Anamorphic drawing of a stag. German, 16th century. The Metropolitan Museum of Art, New York

More recently, the picture has been associated with the work of Cornelius Anthonisz.[8] Similar distortions are found in the allegorical skull in the painting *The Ambassadors* by Holbein, executed in London in 1533, to which I shall be returning later, as well as in the figure of a stag in a German drawing of the sixteenth century (fig. 12).[9]

Another passage contemporary with Hentzner could refer to the same anamorphic portrait. In his description in *Richard II* (1595–6) of a fit of grief, Shakespeare alludes to similar distortions which appear to a troubled eye.

For sorrow's eye, glazed with blinding tears,
Divides one thing entire to many objects;
Like perspectives which, rightly gaz'd upon,
Show nothing but confusion, – ey'd awry,
Distinguish form![10]



The Lord Chamberlain's Men, a theatrical company to which the playwright belonged, played occasionally in the palace where the strange portrait of Edward VI then hung.[11] Shakespeare, like Hentzner, may have been struck by it.

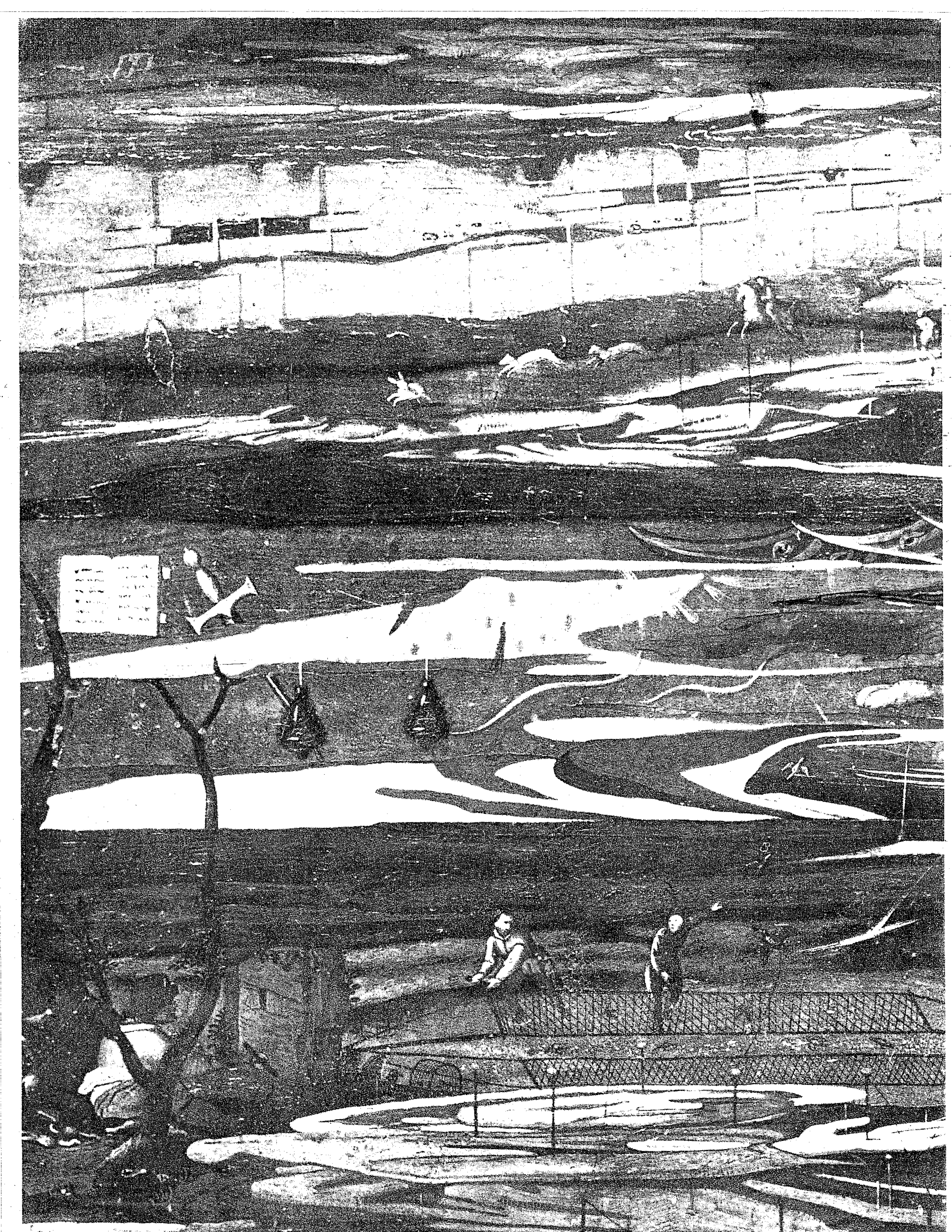
Depictions of saints were subjected to similar treatment. The second panel of the Lipchitz Collection, without doubt belonging to the same workshop if not to the same hand as the portrait of Charles V, seems at first sight a mere agglomeration of egg-shaped forms, empty of content, reminiscent of a modern abstract painting (fig. 13). They are grouped around two small tables and a bench with extraordinarily broad legs. The only living creatures, two butterflies, are alighting on a lozenge shape below. The optical correction reveals a monk kneeling before a table – the foreshortened bench – on which there is a naked Child. The monk is St. Anthony of Padua to whom Jesus appeared before his death. According to some traditions, the holy men present at this miracle saw only the Saint's face suddenly illuminated.[12] Jesus is revealed when the viewer looks at the picture from a position almost in line with the Saint's own view-point. The mechanics of distortion which make the picture unrecognizable are used to compose a fleeting shadow. The arrangement is particularly cunning. Normal figures, mingled with swollen forms, become blurred when seen obliquely. They undergo a complete metamorphosis. One of the two small tables turns into a book, the other into the arms of a cross. The butterflies become fleurs-de-lis. On the ground and on a piece of furniture one recognizes the emblems of the Saint.

Several religious subjects are superimposed on one another in a fourth picture in this series (fig. 14): *Saints Peter and Paul, Christ and the Angel, The Divine Countenance, The Virgin and Child, St. Francis of Assisi receiving the stigmata.*

FIG. 13 Anamorphic picture: Saint Anthony of Padua, c. 1535. Lipchitz Collection, New York

OVERLEAF

FIG. 14 Anamorphic picture: *Saints Peter and Paul, Christ and the Angel, The Divine Countenance, The Virgin and Child, St Francis of Assisi receiving the stigmata.* German School (Nuremberg ?), c. 1530–60. Bazzi Collection, Milan





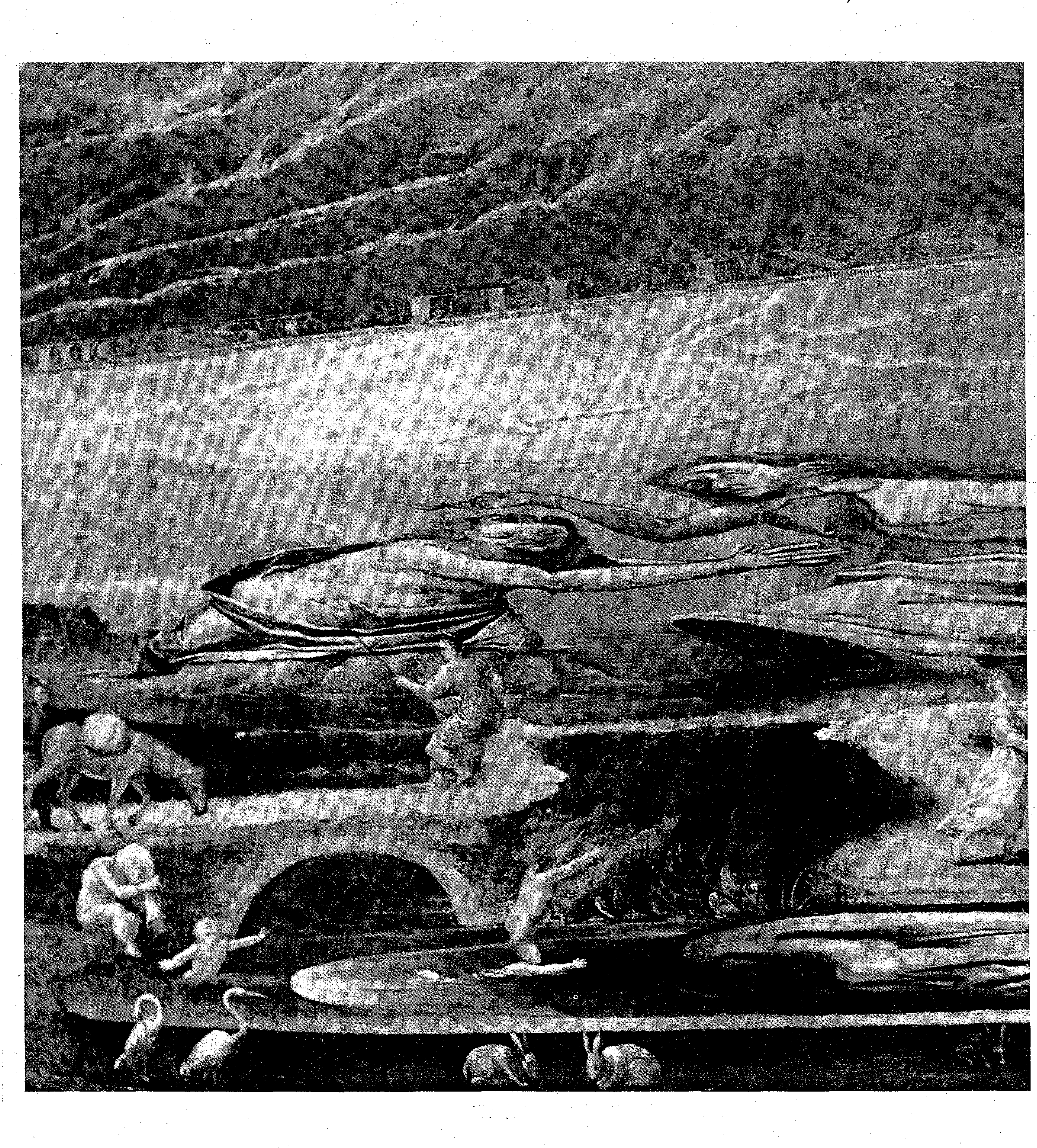




FIG. 15 Anamorphic picture: *The Baptism of Christ, Saint Jerome*. Northern Italy, second half of the 16th century. Cacetta Collection, Rome



FIG. 16 Anamorphic picture: *The Death of Saul.* Flemish School, second half of the 16th century

These pictures are covered by a fragmented and fluid landscape, with, at the top, a sailing ship, a horseman, two hounds and a hare; below, two bird-catchers holding their net; on the left, a tree behind which a huntsman crouches in wait; in the middle, strange forms are strewn on the ground or hang suspended – translucent wings, mysterious objects. As with the portrait of Edward VI, the hidden image comes into view when it is looked at from the sights fixed in the frame. There are four of these – two at each side. With its trapezoidal rows, the composition exactly repeats the geometrical outline of Schön's large woodcut, whose dimensions it only marginally exceeds.[13] Judging by the spare and graphic nature of the drawing, the precision of the figurative groups and their covering, this *Vexierbild* emanates directly if not from the studio at least from the School of the Nuremberg Master. Evidence indicates a date between 1530 and 1560.

A later work, *The Baptism of Christ, St Jerome*, offers an example of anamorphosis in a more supple and less hidden manner (fig. 15). The picture, which bears the stamp of Mannerism, was without doubt executed in Northern Italy.[14] It represents a river, a road, a bridge. On the right St. Jerome is kneeling before the Cross with a lion by his side. On the left, a man advances with an ass, probably the one believed to have been devoured by a wild beast. Around the river are a succession of scenes: a shepherd and sheep, a meal in the open air, a bathing scene, herons, rabbits. Nature is at peace in an atmosphere of rural charm, but a sideways glance reveals two giant figures in the upper part: the Baptism of Christ with the inscription HIC EST FILIUS MEUS DEI and the Holy Dove. Below emerging from the waters one sees the head of St. John the Baptist on a platter. It is the vision of St. Jerome whose monastery was situated in the region of Bethlehem. Sunk in prayer and meditation before the image of Jesus, the hermit evokes in thought the events of the Holy Scriptures that took place in the land of Jordan. The huge figures placed on the landscape remain perfectly recognizable despite the elongation and stand out in it like hieroglyphics.

A second group of these anamorphoses originated in the final years of the sixteenth century and developed in the seventeenth century. It also demonstrates great diversity. One picture, probably Flemish but with strong Italian influence, represents *The Death of Saul* at the battle of Gilboa.[15] The scenes take place in front of a city in flames, on the banks of the Jordan (fig. 16). But Saul remains invisible. He is hidden in the island which stands out in the foreground, on the black waters of the river, illuminated by the conflagration. The king, who is falling on his sword, emerges when one looks at the picture from the side. His proportions are superhuman. He is a colossus, clad in a coat of mail formed by paving-stones; his limbs, flattened and disjointed, are wholly confused with the ground. The river of the Holy Land seems to conceal scriptural imagery, and, like the other example, the drawing includes a bridge. There is another version of the picture in which the soldiers do not wear military uniform and in which the king himself is without armour. That version includes a scene of witchcraft.[16]

In *The Fall*, an engraving by J. H. Glaser, a native of Basle and a pupil of F. Breutel (Strasbourg), the same device is used (fig. 17). Adam and Eve, tasting the fruit, are on the right-hand side of a long, narrow composition. *The Expulsion*

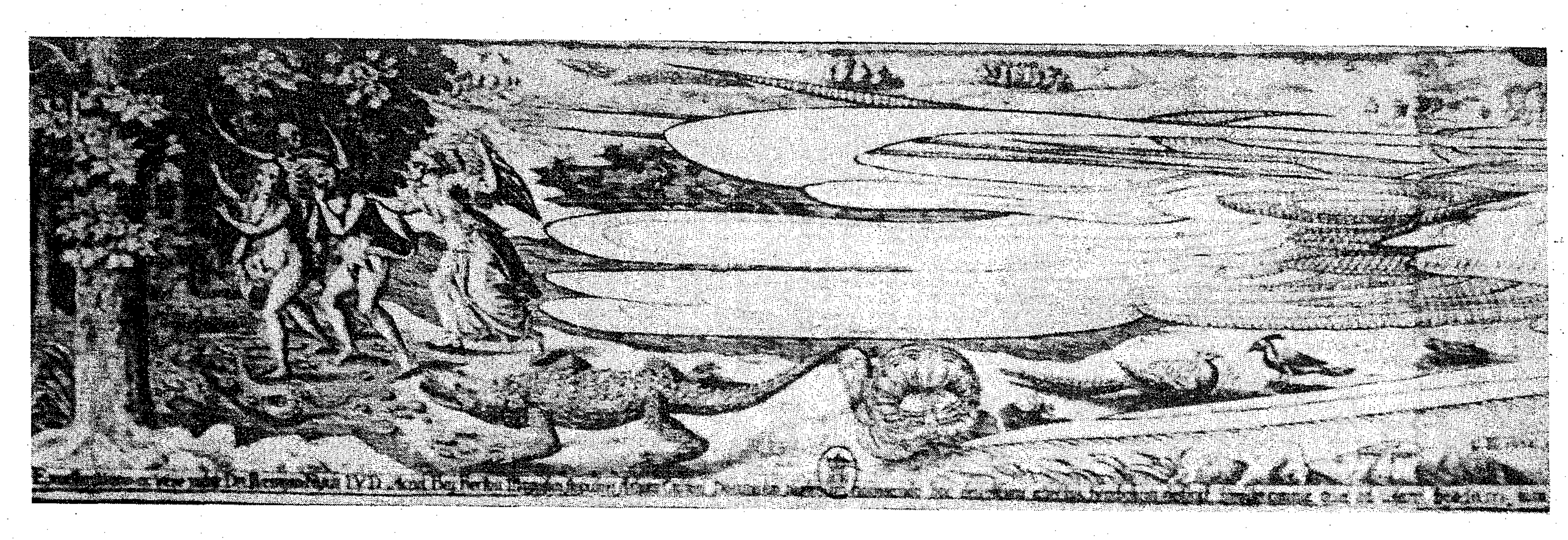


FIG. 17 Anamorphic composition: *The Fall.* Engraving by J. H. Glaser, Basle, 1638

from Paradise, is on the opposite side. A lake stretches between the two scenes; in the foreground are animals and birds of every species; in the background, exotic trees. The scene appears normal, except that the water, which should be calm in this landscape of Paradise, is strangely agitated and seems to be concealing human features. The waves are explained when one looks at them sideways: from them emerges the head of the suffering Christ, the compassionate Christ with the Crown of Thorns. The Redeemer makes his appearance as far back as the Original Sin. The Biblical scene is completed by a hidden representation of a scene from the New Testament. The engraving dates from 1638 and bears a dedication to Remi Fasch, Rector of Basle University.

Anamorphosis also contains fantastic themes. In a drawing by Jacob van der Heyden, a Strasbourg artist who was a pupil of Raphael Coxie at Antwerp, a double fool's-head is elongated so as to look like an ass's head, its ears formed by the nose and the chin.[17] The inscription runs NOUS SOMMES TROIS. In the drawing there is also an inset sketch-plan showing a board and a view-finder on a stick (fig. 18). This work is part of a group originating in the Rhineland and Northern Flanders, but such anamorphoses are also found elsewhere.

Eccentric devices were enjoying a new vogue at this time. It was a period when art and wonder, closely bound up, intermingled. The *Kunst-und-Wunderkammern* which spread during the Renaissance, continuing a medieval tradition, became popular throughout the whole of Europe.[18] The studies of scholars and collectors were piled up with all the wonders of the world – stuffed monsters, rare objects, natural curiosities, perspective instruments, pictures by masters, everything that excited the mind and the imagination. The *Wunderschrank*, a reducing cabinet which Philippe Hainhofer, a connoisseur and merchant of Augsburg had set up in



FIG. 18 Humorous anamorphosis: '*Nous sommes trois*' ('We are three'), drawing by Jacob van der Heyden, 1629. Bibliothèque Nationale, Paris

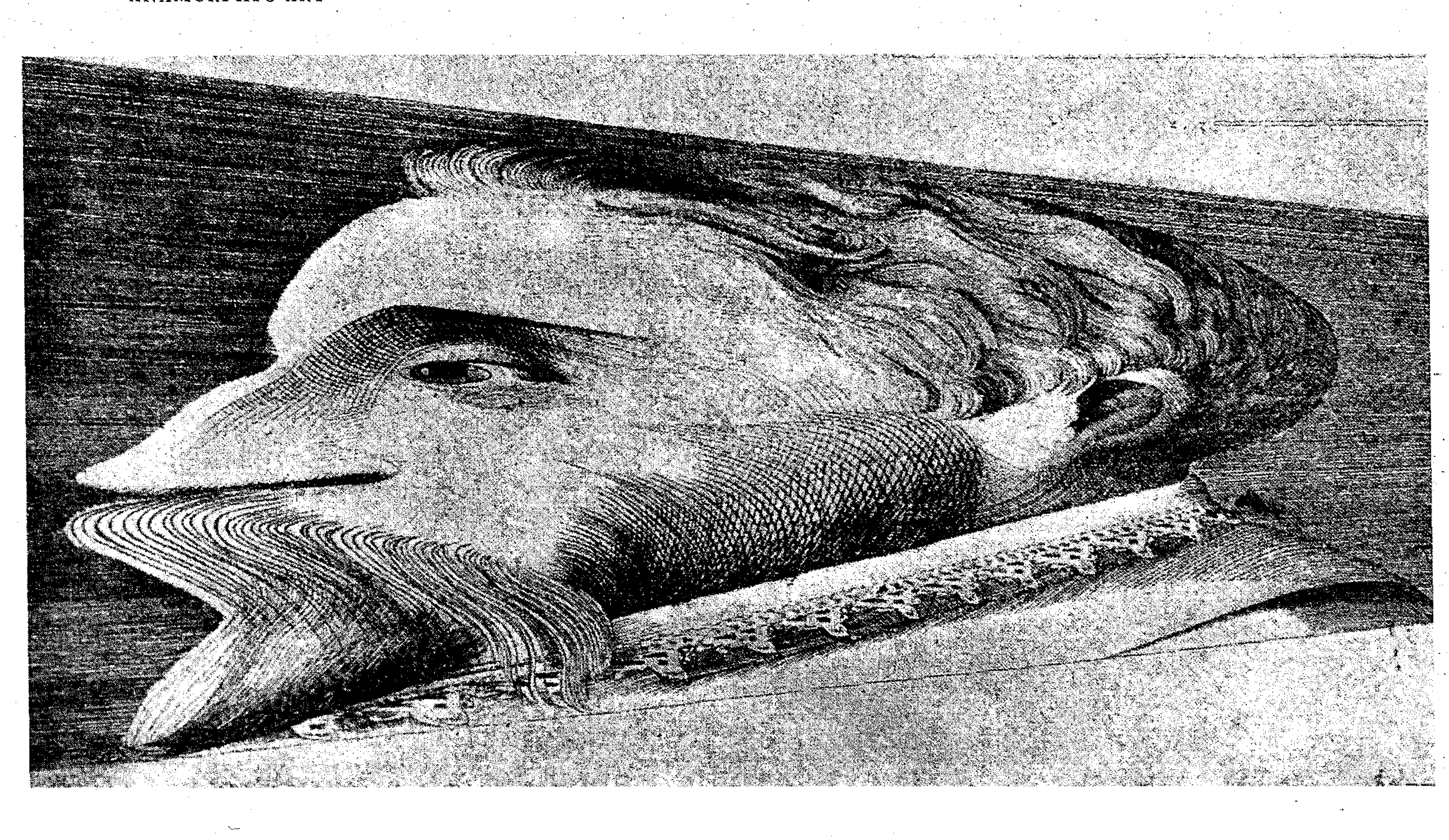
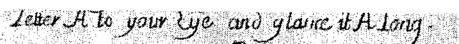


FIG. 19 Anamorphic portrait of Ernest, Duke of Bavaria, Elector of Cologne. Engraving by J. Stommel, 1598

1632 for Gustavus Adolphus of Sweden, contained several anamorphoses. In addition, among the king's papers an engraving by Stommel was discovered (fig. 19) which represented Ernest Duke of Bavaria, with the same distortion as in the portraits of Charles V and Edward VI, and also an anamorphic drawing of animals and a peasant, dated 1598. Anamorphic portraits of Charles I were disseminated in England among the Royalists following the king's execution in 1649. In one of these the king's head is extended upwards so that he has a pointed forehead (fig. 20).[19] The process was also introduced into the décor of buildings. In Rome and in Paris it was applied to very large frescoes in monasteries.

Two phases in the development of anamorphosis can be distinguished: genesis and initial dissemination in the sixteenth century and a revival in the seventeenth century. The importance of the development is revealed by a series of books which provide us with descriptions of certain studios and of the techniques employed by different artists. One of the first references to the procedure appears in *The Two Rules* by Vignola compiled c.1530–40 and published with commentaries by



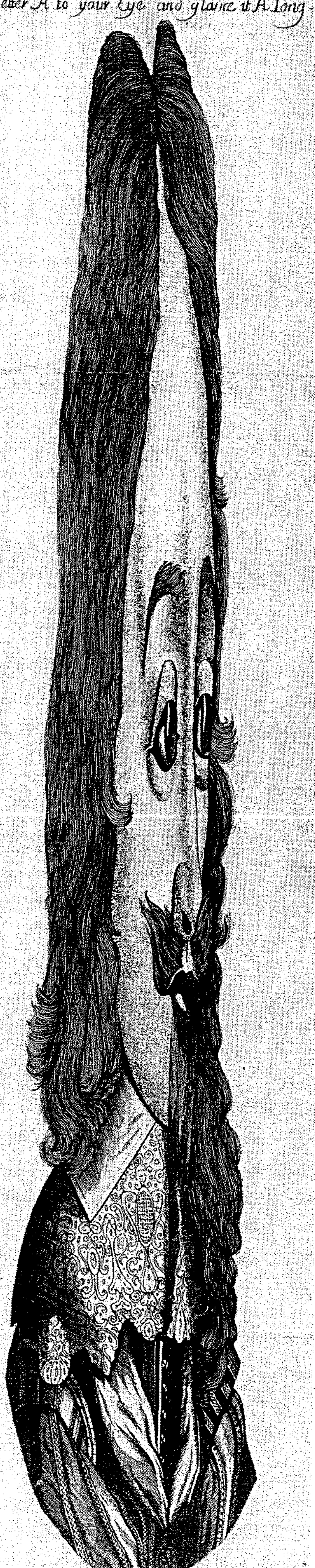
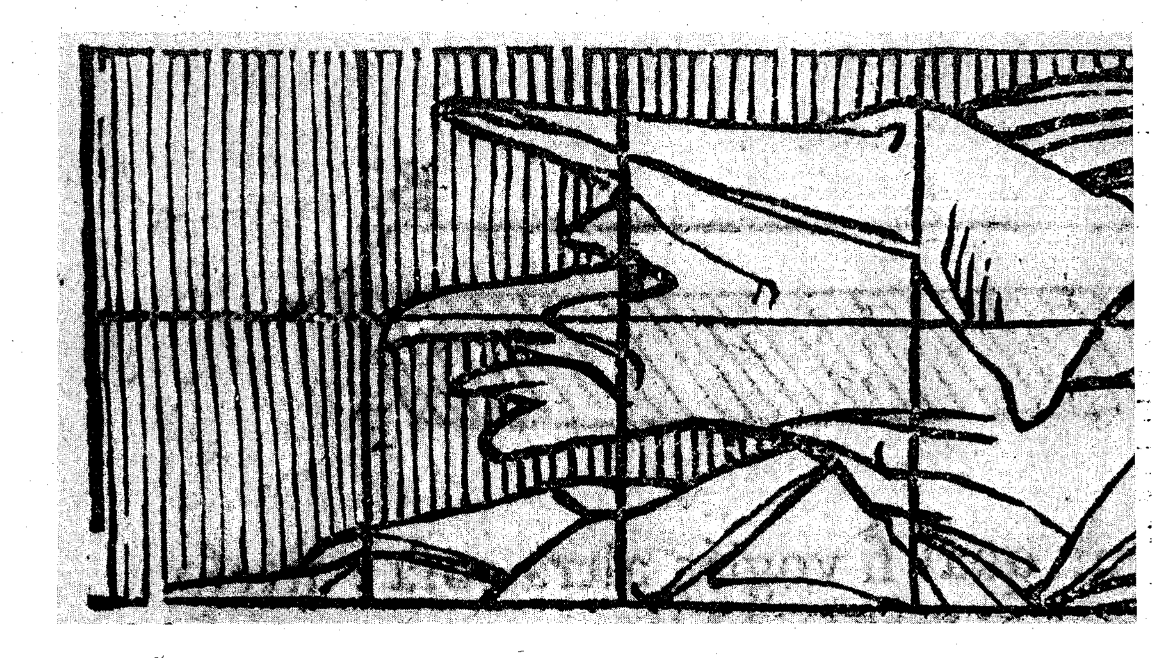


FIG. 20 Secret portrait of Charles I, after 1649. Anthony d'Offay Collection, London

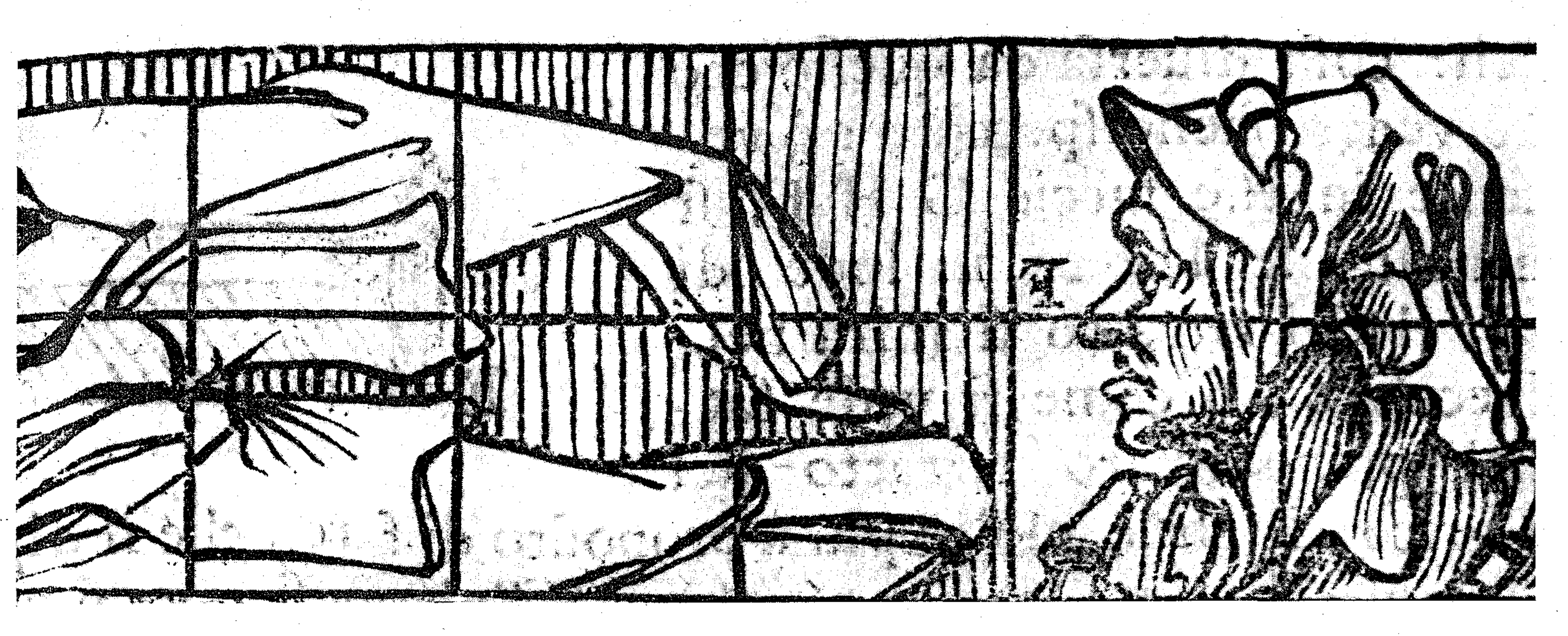


Egnatio Danti, a translator of Euclid, only in 1583.[20] It is the drawing of a head in profile, its length quadrupled by means of a simple grid which ignores the angle of the visual rays which broaden out as they move away from the eye – one of the basic principles of linear perspective. The image is enclosed in a box pierced by an opening from which the foreshortened picture is reconstituted. The device is analogous to that used for the portrait of Edward VI but it is much less sophisticated than the first compositions which have come down to us (fig. 21). The method is attributed to Tommaso Laureti, a Sicilian, often quoted in Vignola's book as a deviser of perspectives and an excellent painter.

The optical 'game' is also mentioned by Giambattista della Porta, a Neapolitan and specialist in the wonders of nature. We read in his *Natural Magic* (1558): 'there is a part of geometry which is called Perspective, which appertains to the eyes and which produces several marvellous results: . . . now it will show you the outside of a figure, then it will show you nothing, and in a strange way it will change its effects, composing various images'.[21] No indication of how these compositions are made follows this precise description of the effects.

The technique is, however, taught about the same date by Daniele Barbaro, Patriarch of Aqueilia and commentator on Vitruvius (Venice, 1556), in his *Pratica della Perspettiva* (1559).[22] Barbaro presents anamorphosis as a revelation: a beautiful and 'secret' part of perspective (Vignola had not yet been published), and as a device in current use.

> Many times with no less pleasure than wonder one looks at some of these pictures or perspective schemes in which, if the eye of the beholder is not placed at the predetermined point, the subject appears quite different from what is painted, but, subsequently looked at from the correct view-point, the subject is revealed according to the painter's intention, be it a matter of depiction of people, animals, lettering or other representations.



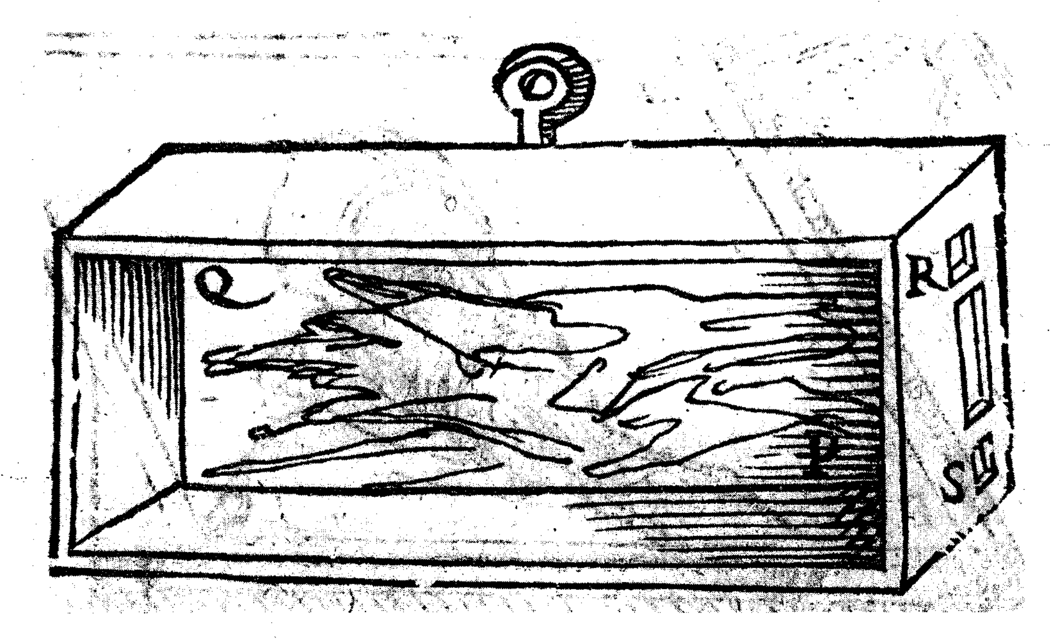


FIG. 21 Extension ignoring visual angle: Vignola-Danti, c. 1540–83

One recognizes here the double projection, with contrasting themes and including inscriptions, several examples of which have already been shown. The operation is in two phases and of unexpected simplicity. Phase one consists in composing the image as it is normally seen: 'Take a piece of paper on which you paint one or two human heads or anything else according to your wish, and on it mark with perforations certain points.' Phase two concerns the mechanical distortion by means of light: 'Take the board on to which you wish to transfer the two heads and fix the perforated paper on one of its sides at a right angle as if the board was one wall and the paper another'. The rays of the sun or of a lantern projected through the holes will trace on the board the heads, which will be elongated and drawn out',

so that seen from the front 'they no longer seem to be heads but to be straight lines and curves that lack any regular form, but, seen from the point from which the rays come, the heads will reassume the form they had on the paper.'

Barbaro also mentions geometrical and other processes: 'It is possible to do the same thing without sun, lantern or perforated paper, using instead the rules and instruments which we shall discuss in the last part' (which deals with perspective apparatus). He fails, however, to provide many details. He is more concerned to bring out the hidden and mysterious aspects of these pictures. Forms within forms must be included. They should be disguised.

> The better to hide what he paints, in accordance with the practices indicated, the painter who is proposing to delineate the two heads or other portrayals must know how to shade and cover the image so that instead of two heads, it shows landscapes, water, hills, rocks and other things. . . . The painter can and, indeed, must deceive our eyes by interrupting and separating lines which ought to be straight and continuous because, except at the viewing-point indicated, they do not reveal what they reveal at the chosen place. . . . The figures can be broken up with some parts separated from others so that they appear to join together again when they are looked at obliquely: thus, the forehead of a face can be placed at one point, the nose at another and the chin somewhere else. . . . And then one would no longer recognize that the painting represents a head, but the nose would seem one thing and the forehead another, and, for example, the painter can make the nose look like a rock and the forehead like a clod of earth if he wishes.

The anthropomorphic landscapes and 'composite' heads which were disseminated at precisely this period by Arcimboldo and his Italian imitators to the North are directly grafted onto these optical distortions.

A fourth book places a whole series of these perspective anamorphoses in the very midst of the painters of Milan. Its author is Giovanni Paolo Lomazzo, theoretician and historian of 'Mannerism', who describes Arcimboldi assemblages. In his *Treatise on Painting* (1584), a whole article is devoted to 'reverse perspective which looks correct when viewed through a single hole' (book 6, chapter 19).[23] The method for dealing with large sizes is set out: 'You will put under a portico, according to the width of the façade, a canvas or sheet of paper of 15 cubits × 1' (about 7 × 0·5 metres). The image, a well-executed head of Christ or a horse, is fixed as in Barbaro's projections. But in this case it is inscribed within a grid which is projected onto the picture with the help of a thread, whilst the drawing is transferred by means of a long stick with a charcoal point. Clearly, the lantern procedure would not have worked for such a large area. But it is not only the monumental nature of these compositions which introduces a new element. The names quoted are no less revealing. Lomazzo states that he has seen 'the optical illusion of a Christ in profile whose hair looked like the waves of the sea' and which when seen through the peep-hole assumed the greatest beauty. This work had been executed by Gaudenzio Ferrari (d. 1546) whom Lomazzo thought to be his uncle. He continues: 'Similarly Francesco Melzi reports that Leonardo da Vinci depicted a dragon in combat with a lion, very wonderful to see, and likewise horses for

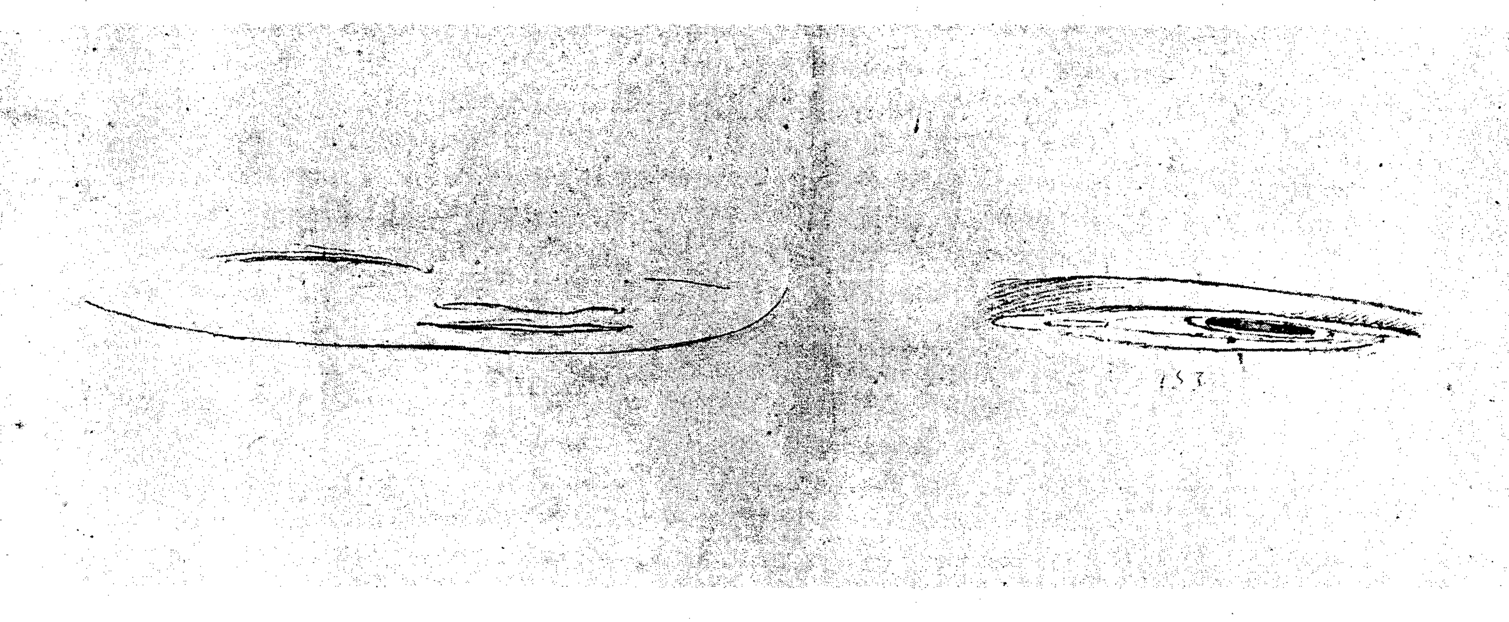


FIG. 22 Early example of anamorphosis: Leonardo da Vinci, Codex Atlanticus, 1483–1518. Biblioteca Ambrosiana, Milan

François Valois, King of France – a method which was clearly understood by Girolamo Figino [pupil of Melzi and also from Milan] for the representation of horses.'[24]

A book and two drawings confirm this testimony.[25] In his *Treatise on Painting*, Leonardo describes the mechanics of progressive foreshortening produced by an oblique viewing, in which unequal intervals are made equal by this 'apparent diminution':

> And if you were to paint this on a wall in front of which you can move freely, the effect would appear out of proportion to you because of the great difference between O R and R Q [the intervals]. This happens because the eye is so close to the wall that the painting appears foreshortened. And if you wished to paint that, however, your perspective would have to be viewed through a single hole.

The method is suggested for a mural composition. The child's face, widened, and the eye, found in the *Codex Atlanticus* (1483–1518) complete the lesson given by this great artist. These drawings are the oldest known examples of anamorphoses (fig. 22).

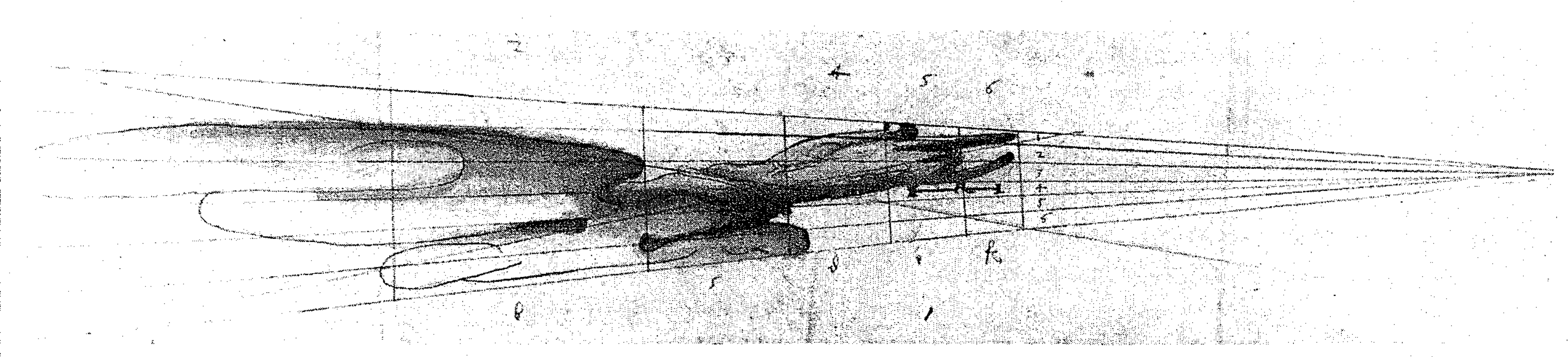
The anamorphic game is thus directly associated with a genius and with artists of the top flight. The value of such testimony cannot be over-emphasized.

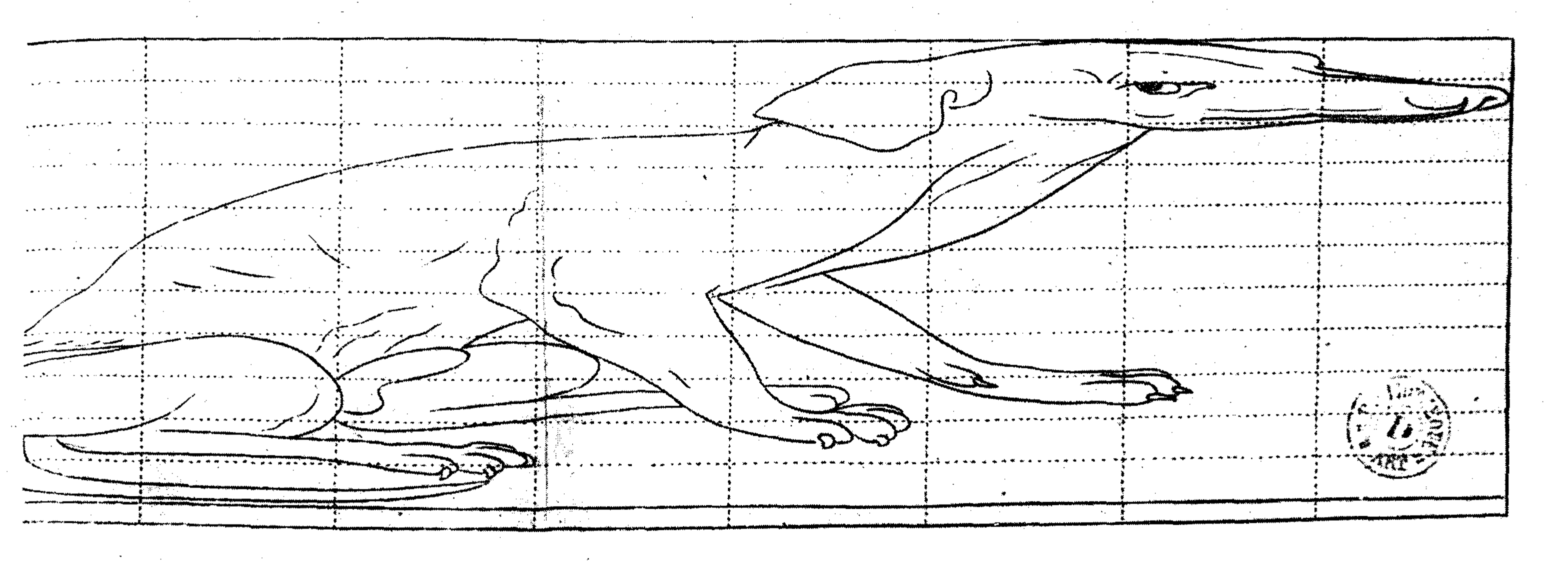
Although the majority of works preserved from this period are to a greater or lesser extent linked with Germanic influences, it is to Italy that we owe the first technical instructions on anamorphosis and mention of earlier works. We also know through Accolti that Cosimo II de' Medici (1608–20) had himself represented in a painting which 'demonstrated the power of perspective in its deceptions', as in the portraits of Charles V.[26] It is therefore virtually certain that those centres

which developed perspective in general to such an extent also invented its paradoxes. When Dürer was in Italy in 1506, he could well have already assimilated the basic principles. In a letter sent from Venice to his friend Williband Pirkheimer, he said that he was about to go to Bologna to learn the art of secret perspective *die Kunst in geheimer Perspektive* which someone was anxious to teach him.[27] It was the same term *una bella e secreta parte di Perspettiva* which Barbaro used to designate the devices of elongation. Furthermore, the cases of decelerated perspective which we have noted in Dürer are near-anamorphoses.[28] With its spirals, close at first, then extended, moving vertically to the summit, the twisted column is more like a monstrous serpent than an architectural support (fig. 3). In theory these contortions, when seen from below, should appear regular. In reality, by rectifying the proportions by the angle of vision, Dürer begins to destroy them. The structure becomes completely distorted, as in the pictures by Erhard Schön, his disciple. Dürer's letter from Venice is of prime importance on two counts: it marks an important stage both in the extension of optical devices into the realm of the fantastic and in its introduction into an environment which was still close to the Middle Ages. Whilst Italy thought of perspective primarily as a caprice and amusement of painters, Europe to the north of the Alps conferred on it a power and sturdiness that approached the dramatic and the burlesque.

All this, however, is supposition. We lack the evidence required to establish precise connections. The first printed texts are of a later date than the dissemination of the first series of anamorphic compositions, and the methods they describe seem less developed than the techniques employed in those compositions. The virtuosity of a Schön goes beyond a simple elongation that ignored angles of vision and optical diminutions, and the finesse and the precision of his complex drawings exclude the possibility of protecting them through large holes in perforated paper or the use of a sketch made with a long stick, a technique which was envisaged for

FIG. 23 Anamorphic diagram by the Master H. R.,Nuremburg, c. 1540. University Library, Erlangen





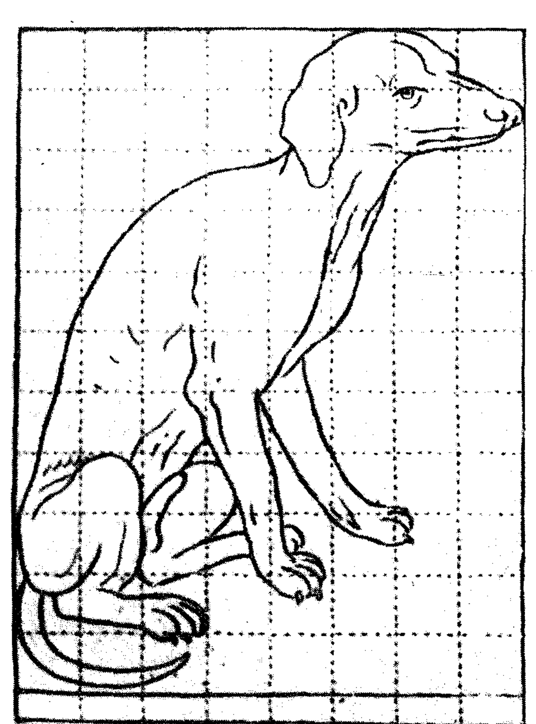


FIG. 24 Old-fashioned anamorphic method: Samuel Marolois, The Hague, 1614

works of very different dimensions and which could not be applied to engravings.

Furthermore, a contemporary drawing (c.1540) by a native of Nuremberg, the Master H. R., reveals a knowledge of sophisticated geometric processes in that artistic milieu.[29] It is a triangular diagram, crossed by a single diagonal, fixing – by means of its intersections with the visual rays opposite – all the distances of the elongation (fig. 23). Since the subject is merely a hand emerging from a cloud, the very nature of which implies extensions and contractions *ad infinitum*, the composition seems to have been intended as a technical demonstration. Its dimensions (0·36 m × 0·75 m) correspond to those of the anamorphic plates engraved in the

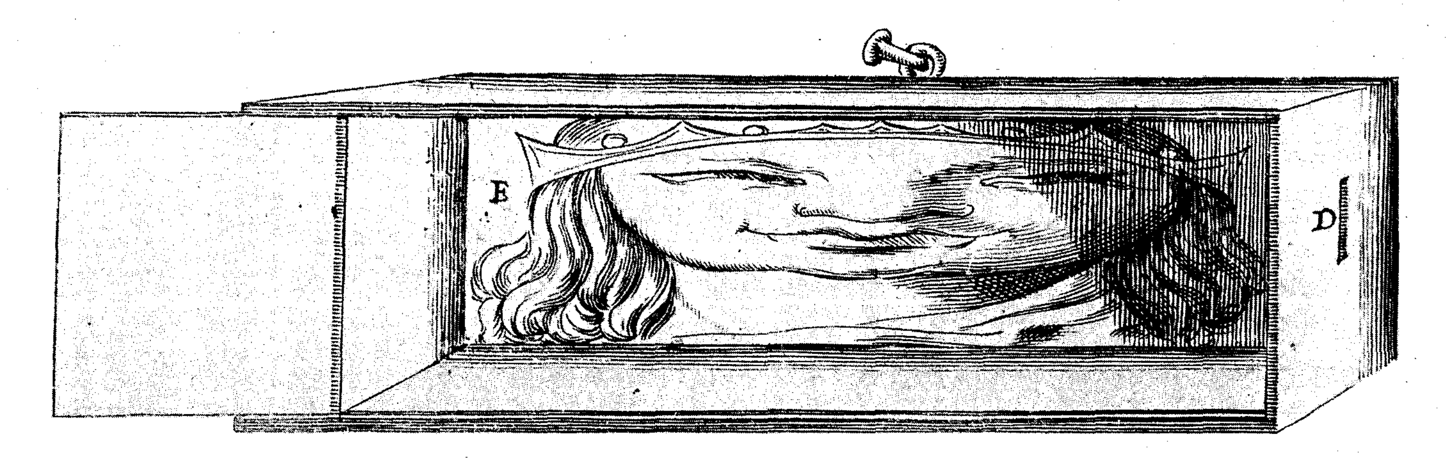


FIG. 25 Old-fashioned anamorphic method: Mario Bettini, Bologna, 1642.

same town by a pupil of Albrecht Dürer within a year or two of the same date.

The formula, which was to become classic, marks a considerable advance on what had for a long time been found in the treatises on perspective circulated among artists. While the first group of anamorphic compositions was being disseminated, good processes were no doubt jealously guarded. It was only in the course of the seventeenth century with the formation of the second group and its many developments that precise geometric procedures were completely revealed. The whole business came about in progressive stages.

Vignola's rudimentary method continued to be used by some: in the Low Countries, by Samuel Marolois in 1614 with the figure of a dog which, elongated, becomes a caricature of a basset-hound (fig. 24);[30] in Italy, by Mario Bettini in 1642 with a front view of a crowned head, in a perforated box (fig. 25).[31] In the meantime, however, all the arrangements based on the angle of vision, in accordance with better rules, had been methodically revealed by French scholars.



CHAPTER THREE

French masters of perspective: Salomon de Caus, Niceron, Maignan

In the seventeenth century two men above all devoted themselves passionately to studies in the field of perspective. They were Salomon de Caus and Jean-François Niceron, the former an engineer and architect, the latter a scholar and mathematician.

Salomon de Caus (1576–1626) was born in the Dieppe region, but moved a great deal in Flemish and German circles in which anamorphoses seem to have been particularly in vogue. We see him in Brussels in the service of the Archduke Albert II of Austria (1605–10), next in England where he worked in the Richmond Gardens and in Greenwich Palace for Henry, Prince of Wales, then with Frederick V, Elector of the Palatinate and King of Bohemia (1619). He spent the final years of his life in France. A cosmopolitan and an intellectual with wide-ranging interests, he wrote on music, on automata, on solar clocks and on Euclidean proportions.[1] His book *Perspective* appeared in London in 1612 and in Paris in 1624.[2] In the sum total of his work, this book takes its place as one chapter of a vast treatise on the wonders of the world, in which the harmony of sounds and shapes, the mechanics of vision and of hydraulic machines are presented on the same level. Although the author writes in the sober style of a technician, he is deeply aware of the poetry of his subjects.

Jean-François Niceron (1613–46) (fig. 26), a Parisian of the Order of the Minims,* did very little travelling. He journeyed only to Rome, in 1635 and 1642, where he joined a group of other monks in the French monastery of Santa Trinità dei Monti, and became absorbed in work of a similar scientific nature. He died at the early age of thirty-three at Aix-en-Provence. He was acquainted with every treatise on perspective: of the Middle Ages – Vitellion and Alhazen; of the classical series – Alberti (1435), Viator (1505), Dürer (1525), Serlio (1545), Barbaro (1549), Du Cerceau (1576), Danti-Vignola (1583), Sirigatti (1596); of his immediate predecessors – Salomon de Caus (1612) and Marolois (1614); and of his contemporaries – Fernando di Diano (Polienus) (1628), Vaulezard (1630), Desargues (1636). The first edition of Niceron's *Curious Perspective* is dated 1638.[3] It was followed by a Latin version: *Thaumaturgus opticus*, published in 1646, after his death.[4]

*See translator's note p. 50


F. Ioan. Franciscus Niceron
delinea Romæ ano Sal. 1643
Ætatis suæ 29.

This was a much more developed work which served as a basis for further versions in French published in 1652 and 1663.[5] It is a scientific work in which science unfolds in a fairy-tale atmosphere. The book's sub-title: 'in which, besides being a summary and description of the general method of ordinary Perspective, practically demonstrated on the five regular bodies, is also taught the way of making and constructing all kinds of distorted figures which when seen from their correct viewpoint appear in correct proportion', juxtaposes 'Curious Perspective' and 'marvellous effects produced by artificial Magic'. Thus we also see magicians quoted: Pererius, Bulengerus, Torreblanca. And the effects of this magic are described as 'the most beautiful and admirable that the art and industry of Man can achieve.' In this connection Niceron, undoubtedly deriving his information from Cornelius Agrippa, refers to automata: the sphere of Posidonius which showed the movements and periods of the planets, the wooden dove of Architas which could fly, the automaton of Daedalus and 'the bronze head made by Albertus Magnus which spoke as if by nature, and the wonderful works of the learned Boethius who made bronze snakes hiss and bronze birds sing. . . .'[6] Conceived on the lines of a precision machine with its mechanism hidden, perspective that distances and diminishes, that shifts and animates forms in the universe of illusion, belongs to a similar order of miracles. Niceron stresses these connections:

FIG. 26 Jean-François Niceron of the Order of Minims, with S. Trinità dei Monti in the background. Portrait executed in Rome, 1642, by Michel Lasne. From the *Thaumaturgus opticus* (Paris, 1646)

> If, I say, these authors ascribe these miraculous productions – [the automata] – and an infinity of others which we read about in books, to the power and operations of artificial Magic, we can certainly claim the same thing about the effects of perspective which are no less to be prized and admired. Philo the Jew in his book *De Specialibus legibus* states expressly in these terms that true magic or the perfection of sciences consists in Perspective, which enables us to know and discern more perfectly the beautiful works of Nature and Art and which has been at all times in high esteem not only among the common people but among the most powerful monarchs of the world.

Although Salomon de Caus was occupied simultaneously with the *Reason of Moving Forces* – automata – and with perspective as belonging to the same category, Niceron justifies himself with a whole piece of philosophical and historical reasoning.

Salomon de Caus devotes three chapters of his book to the method of 'foreshortening in such a way that the said foreshortening will seem to be unnatural and extravagant, yet nevertheless seen from the chosen view-point will represent the object foreshortened as it would naturally appear'.[7] Niceron has a whole book – the second – 'in which are set out the means for constructing several sorts of figures, which seen from elsewhere than the chosen view-point will seem distorted and senseless, but seen from the view-point will appear correctly proportioned'. The third and fourth books deal with catoptric anamorphoses and dioptric arrangements. They teach the mechanics of nonsensical, extravagant and distorted forms as an exact science. We are no longer concerned with empirical methods as in Vignola and Barbaro or even to some extent in Lomazzo, but with a science based on the geometry of visual rays and on precise calculations.

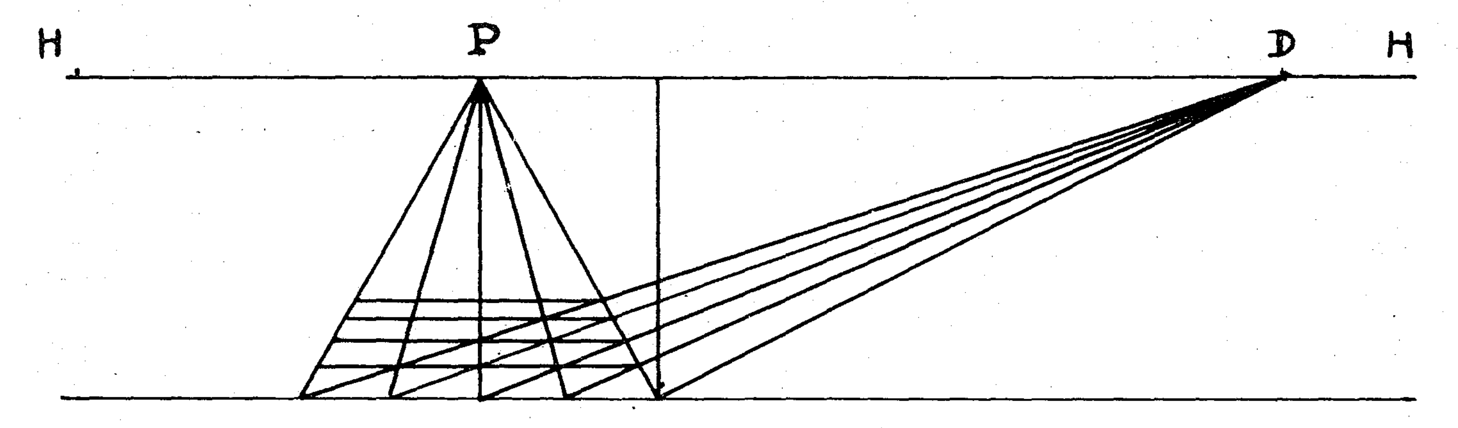


FIG. 27 *Costruzione legittima:* after Leonardo da Vinci, Library of the Institute of France, 1492, MS.A, fol. 42

Let us sum up in a few words what had so far been the devices employed by artists for the organisation of their pictures according to normal perspective. First, the Horizon Line is drawn at eye level. Next two points are fixed: in the centre, the Principal Point towards which all the receding parallel straight lines converge; on the same horizontal line and at the same distance from the Principal Point as the eye, is the Point of Distance towards which the diagonal lines converge. To obtain the full effect, the spectator must place himself at a fixed view-point (fig. 27).

The space receding into the distance is thus divided by the drawing of the grid in which the distances corresponding to each square are determined by the intersections of two sets of straight lines. The result is a trapezoidal chequerboard on which all that now remains to be done is to place the figures, in proportion to the receding dimensions of the parallelograms. The system, in Italy often called *costruzione legittima*, goes back to Alberti (1435), Leonardo da Vinci (1492, MS.A. of the Library of the Institute of France), and Viator (1505).[8] One sees it next in Vignola's second rule, and it is taught in the majority of artists' manuals. It corresponds to the reality of perception but it is also a device for representation which works in every situation. Reversed and extended, it also serves as a basis for a distortion ready for an optical correction.

The arrangement has a two-way function. If a square in perspective appears as a trapeze, a trapeze appears as a square: a reversal of the viewing point, placed above the Principal Point (at a height equal to its length away from the Point of Distance) and set in some way in the picture results in the opposite effect. The same diminutions correct the forms and bring them close instead of putting them at a greater distance and distorting them, as in a film running backwards. The perspective is in reverse.

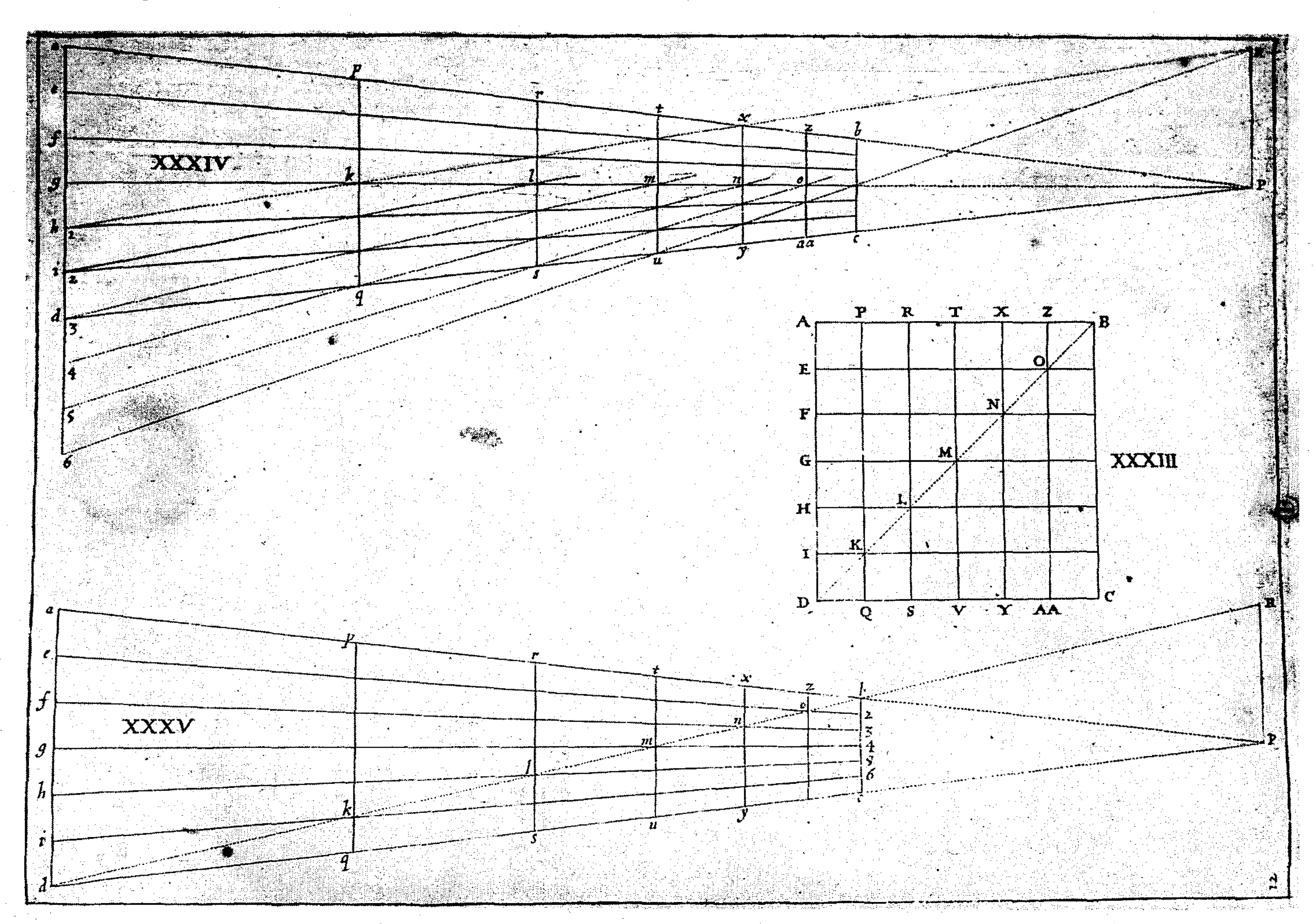
Once the mechanics of the operation were found, attempts were made to increase the effect by exaggerating the proportions absurdly. This was achieved by pushing back the Principal Point and simultaneously closing up the Point of Distance. The

squares are then violently stretched out and diminish at a rapid rate. Their succession is so strongly contrasted that they are no longer of equal size, but they become equal again when they are viewed from the reverse view-point.

At first, the process served to verify normal perspective by its reversal. It was next taken to the extreme limit. The experiments on figures that expand as they move across space and that return intact, as by an automatic contrivance, resulted in independent systems which had a value of their own.

In its practical use, the linear network varied from the simple to the complicated. Salomon de Caus composed the framework in direct accordance with Vignola's first rule, by means of the visual rays and their intersection with the 'partition line', an imaginary line rising vertically in front of the object. Thereby de Caus obtained the same distance and the same angles as by the *costruzione legittima* (rule II) lengthened, which he also employs in some cases. Niceron, on the other hand, relies exclusively on Barbaro's automatic method in his geometry. Usually he draws only a single diagonal line which suffices to fix the scale of all the squares (fig. 28).

FIG. 28 Anamorphic schemes by Niceron, 1638



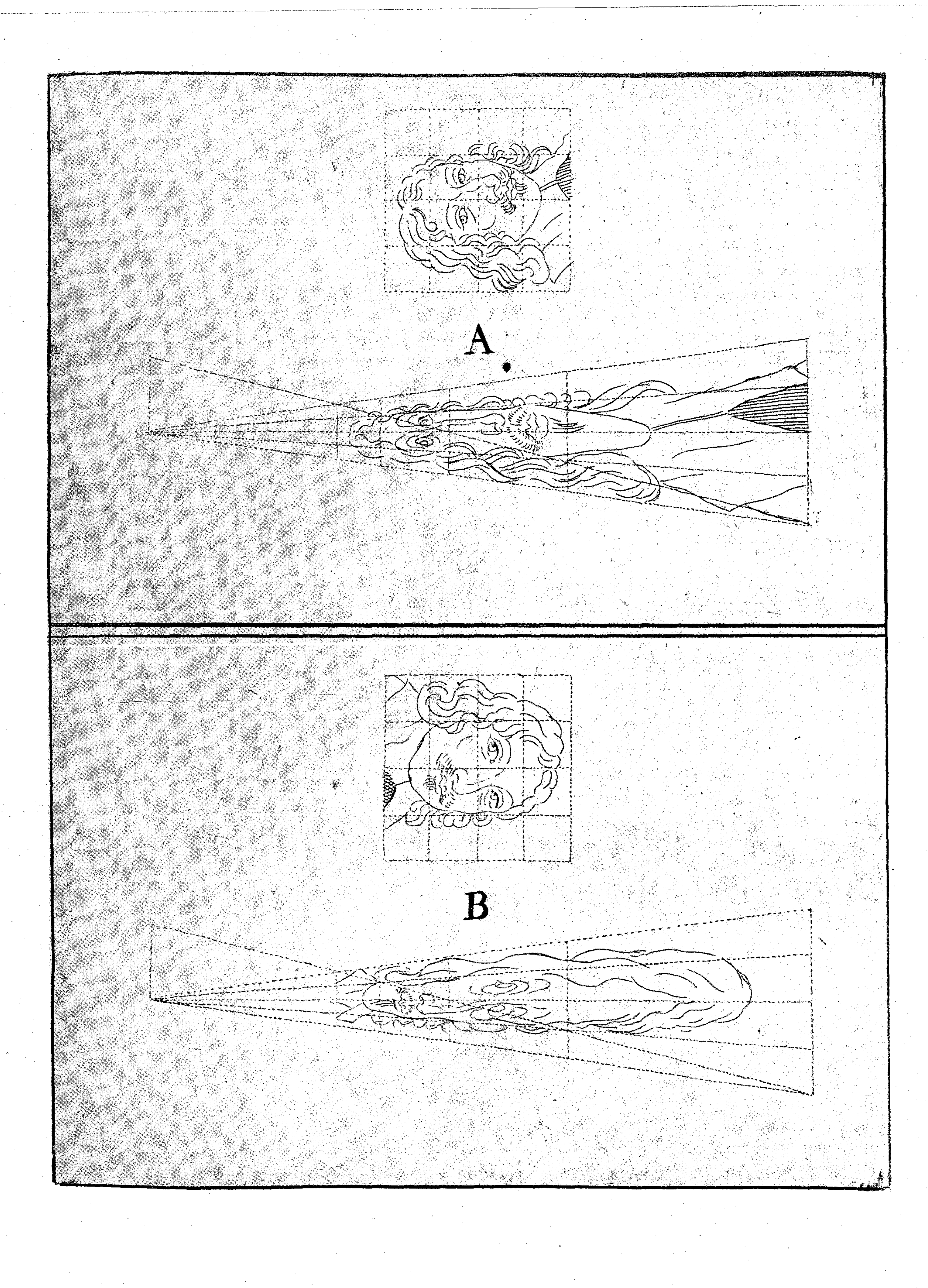

A
B

FIG. 29 Anamorphic schemes by Fr. Du Breuil with the portrait of Louis XIII, 1649

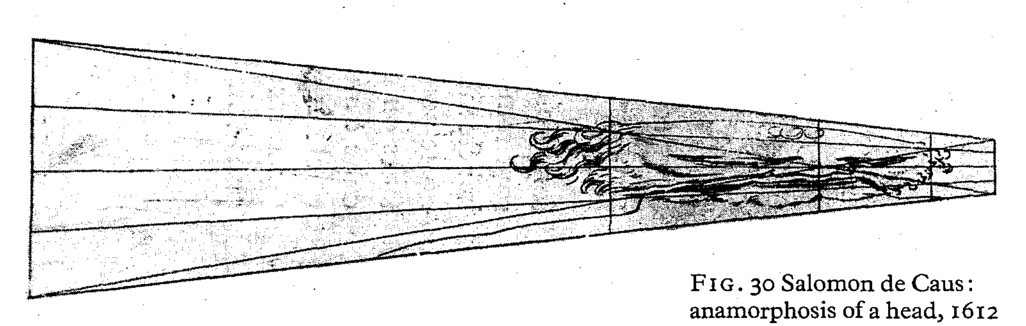
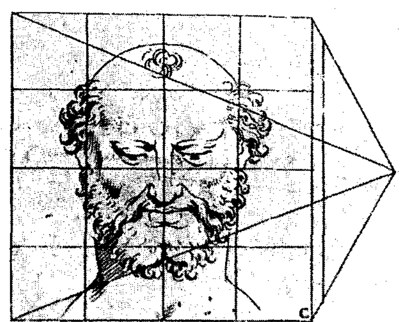


FIG. 30 Salomon de Caus: anamorphosis of a head, 1612



This is the very method provided by the Nuremberg artist (the Master H. R.) exactly one century previously. The layout was later universally adopted. It was taken up again in 1649 by Fr. Du Breuil (fig. 29).[9]

In the illustrations in de Caus and Niceron, heads perpetuating the tradition of the distorted portraits of the sixteenth century are particularly common (figs. 30 and 31). However, we also see whole persons and objects: in de Caus, an actor

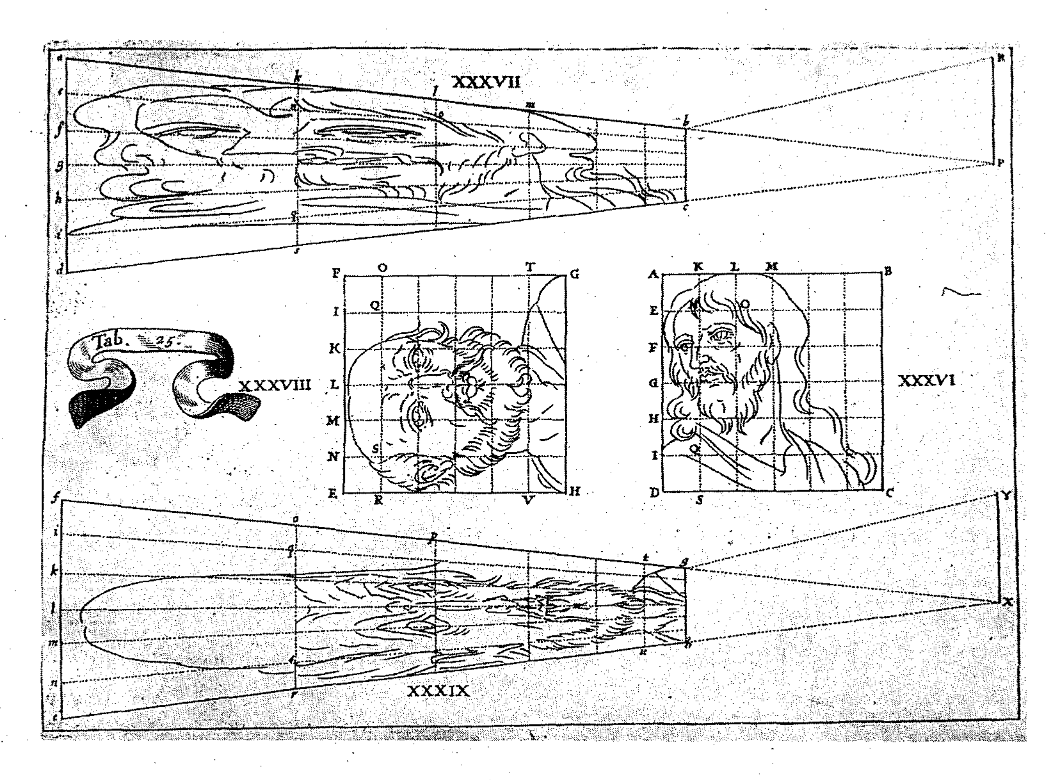


FIG. 31 J.-F. Niceron: anamorphoses of a head, 1638

nails. With Fr. Du Breuil, cones and pyramids hung from the ceiling and were set on the floor and on tables.[11] Whole rooms, veritable collections of conical perspective, were filled with these toys (fig. 35).

Similarly, anamorphic schemes on flat surfaces were not only applied to engravings or paintings done on an easel, but were also devised for the mural decorations of a 'gallery or room' (Salomon de Caus), as in Lomazzo's description. The larger

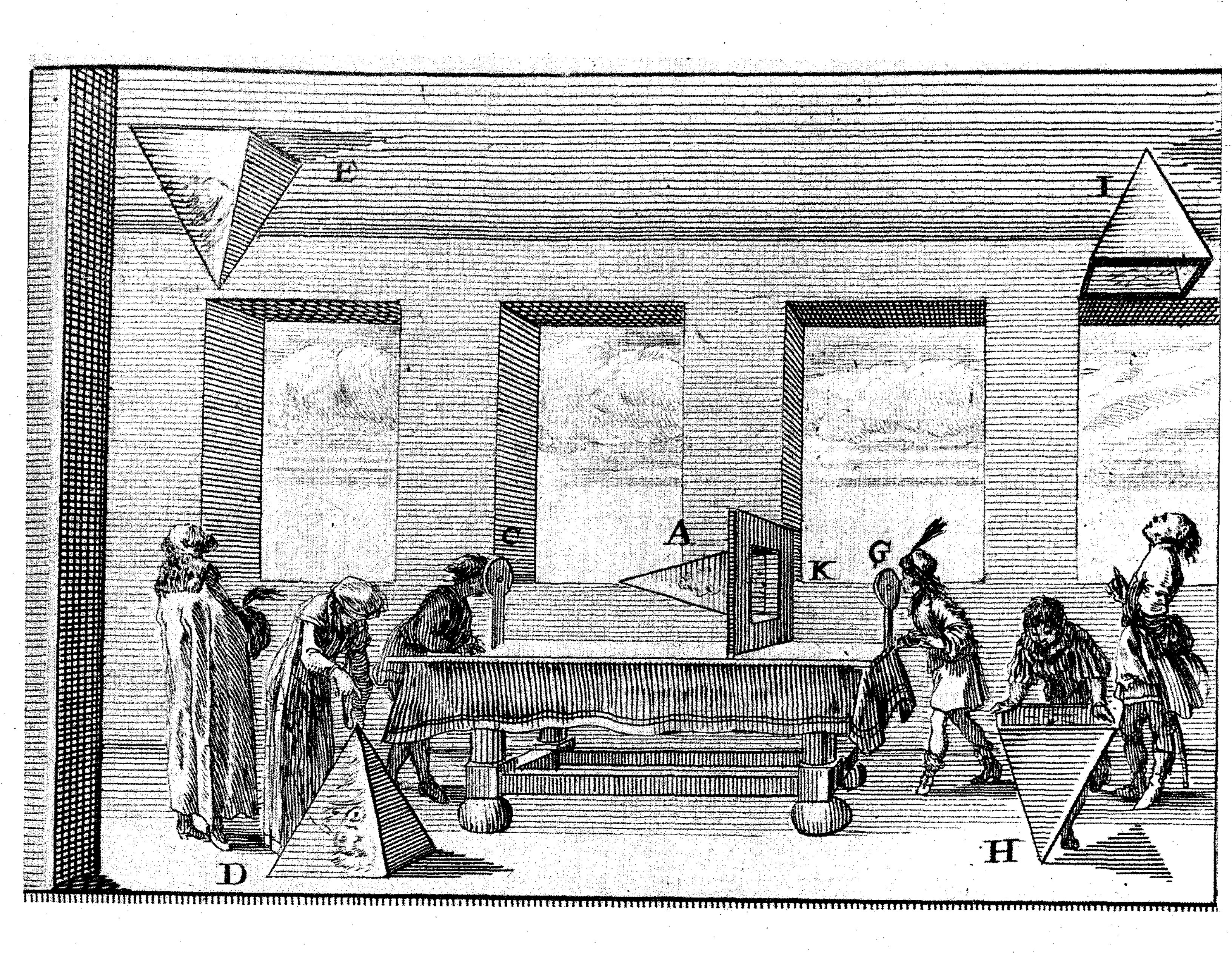
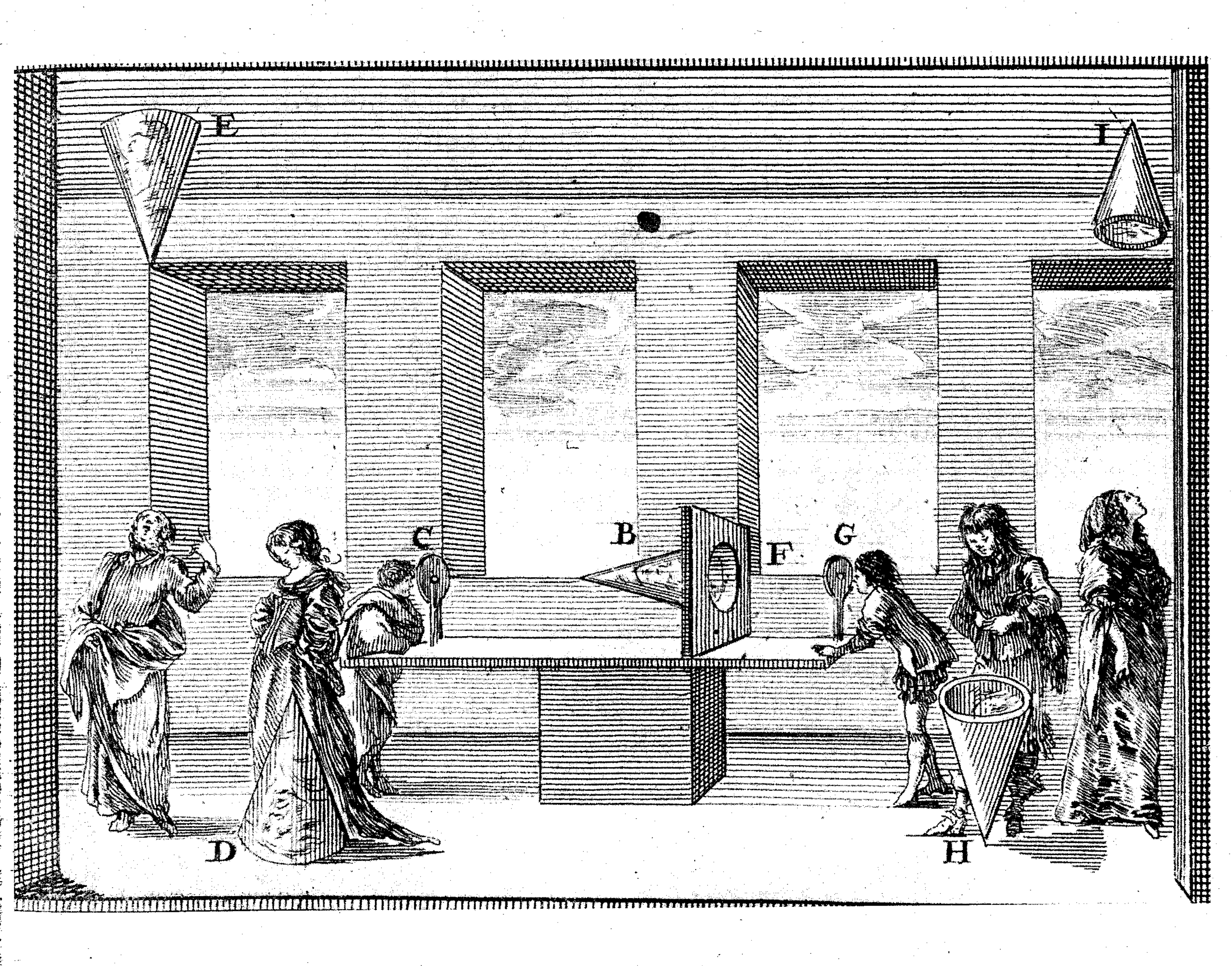
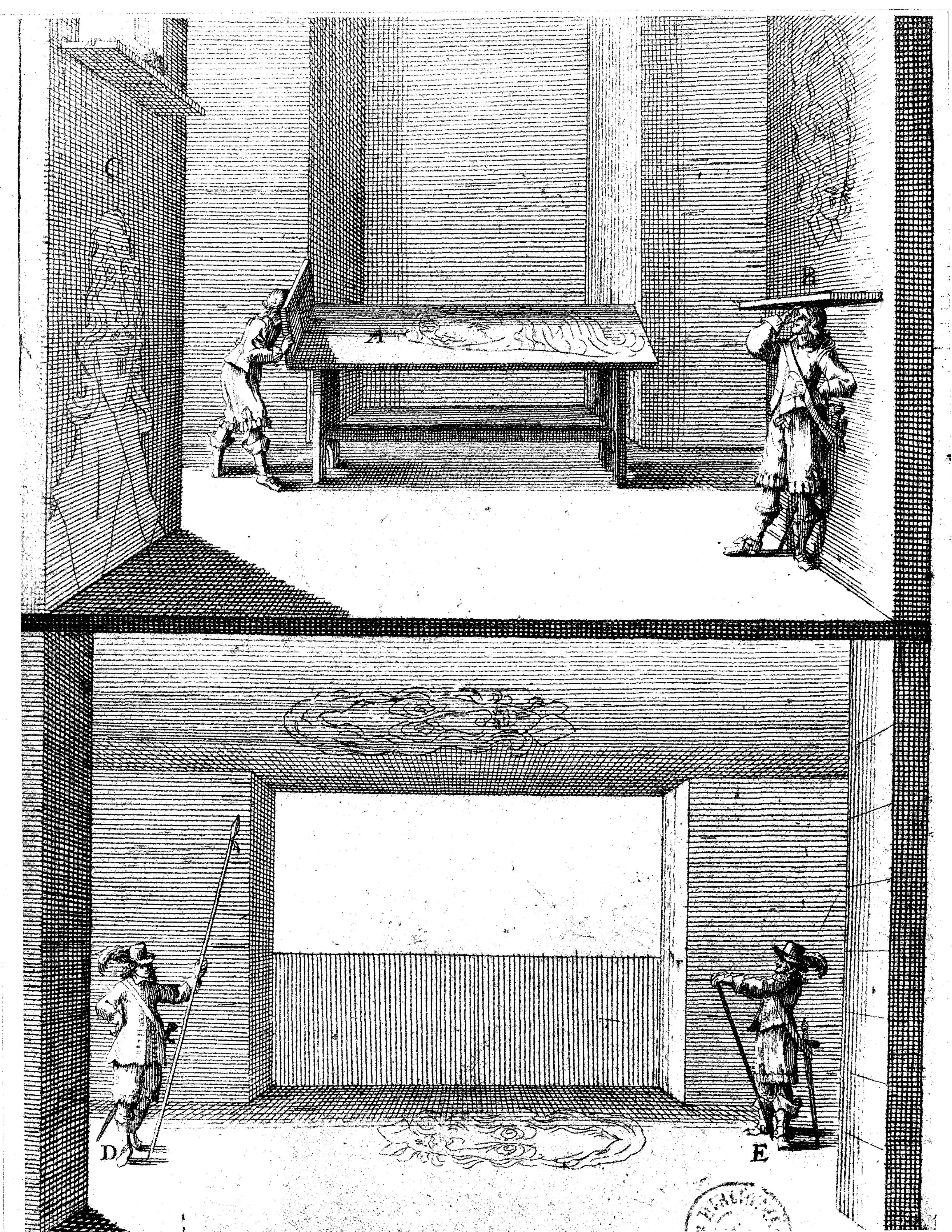


FIG. 35 Fr. Du Breuil: collection of pyramidal and conical anamorphoses, 1649

the drawing, the more exact and ample is the effect; thus, some of these compositions are of enormous dimensions. Niceron lists three types, according to the viewpoint and its relation to the subject and its siting: 'optical' when one looks horizontally along a vast hall or gallery; 'anoptric' when one looks up towards the top of a very high wall, and 'catoptric' when one looks down, for example, from an open window, above a painting designed to be thus viewed. Introduced into the




A
B
D
E

classification of elongated pictures, these terms borrowed from Coelius Rhodiginus, refer to a vast programme.[12] Fr. Du Breuil's *Practical Perspective* (fig. 36) shows how these schemes were worked out. We see two rooms filled with distorted images. There are giant strangely elongated heads on the walls, on the floor and ceiling, even on a table. Panels with holes through which people peer, analogous to the sighting-point on Vignola's frame, are arranged in front of some of these compositions. The commentary suggests that these images can either be painted or executed in marquetry. The rooms are like rooms of ghosts in which faces rise up on every side and vanish as one moves about.

FIG. 36 Fr. Du Breuil: collection of 'Optical', 'Anoptric' and 'Catoptric' anamorphoses, 1649

Niceron also suggested these devices for the décor of ornamental caverns:

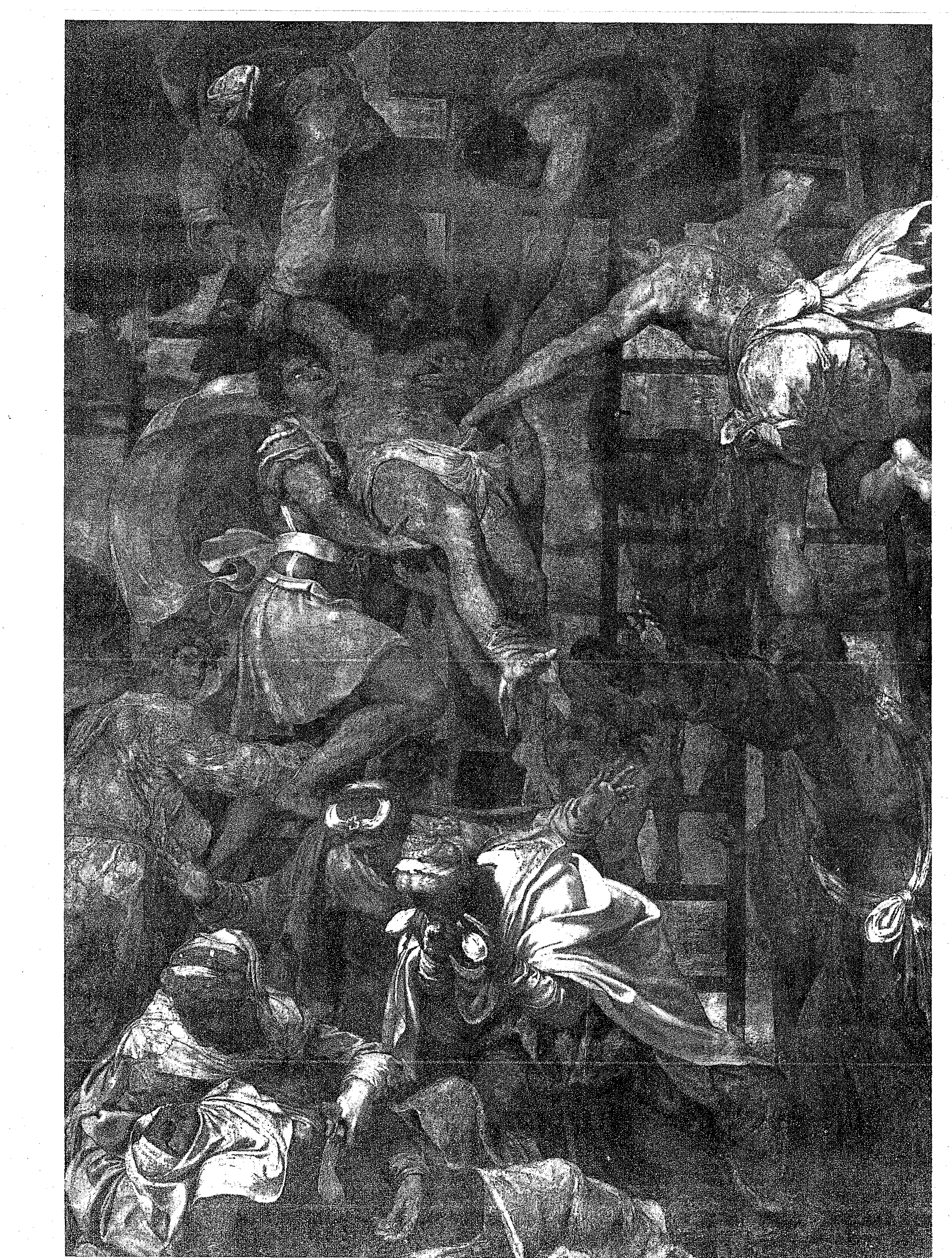
> for those who work in them usually create masks, statues, satyrs and other grotesque figures made of shells, using their natural colour and outline according to what is most appropriate for the representation of certain parts. By applying these rules of perspective to shell-marquetry they can make distorted and confused figures which would not represent anything except from the predetermined viewpoint, and this will be all the more pleasing in that in these works which seem to call for nothing but simplicity, one will see perfect images and well composed pictures.

The cones and pyramids which one could hang up 'like the keystones in our churches' are particularly recommended for these caverns.[13]

Were any of these anamorphic curiosities realized in important works? Niceron quotes and describes several examples which existed in his time, two of which are still preserved. In the edition of 1638 he praises one single great work. Others were added in the 1646 edition. The first is

> a fresco in a chapel of our Monastery (of the Minims), of S. Trinità dei Monte Pincio in Rome, showing a *Descent from the Cross* in which Christ is so depicted that viewed from the left He seems to be lying down and leaning across the picture, with His right foot thrust out towards the left; but viewed from the other side His whole body appears almost vertical, much more foreshortened, and the foot which seemed to protrude on the left side appears to advance towards the right. The effect can be seen in the great altar of our church in the Place Royale where we possess a well made copy of this picture [fig. 37].

The original fresco which once surmounted the high altar of the Rovere Chapel in Rome was by Daniel Ricciarelli di Volterra, one of Michelangelo's immediate circle, who in the same church about the middle of the sixteenth century had executed an *Assumption of the Virgin* 'in which we note that in place of the Twelve Apostles he represented the most talented painters of his century'. Michelangelo is one of those so portrayed in the picture, which is still *in situ* in the Rovere Chapel. As for the *Descent from the Cross*, of which the Paris monastery possessed a copy, after several restorations and relaying onto canvas in the time of Napoleon I, it was relegated in 1855 to a side-chapel. Vasari refers to the foreshortenings in it as being of 'an unusual complexity and beauty'.[14] With its confusion of figures, swaying in every direction, the whole picture explodes in a swirl of Baroque. While the optical



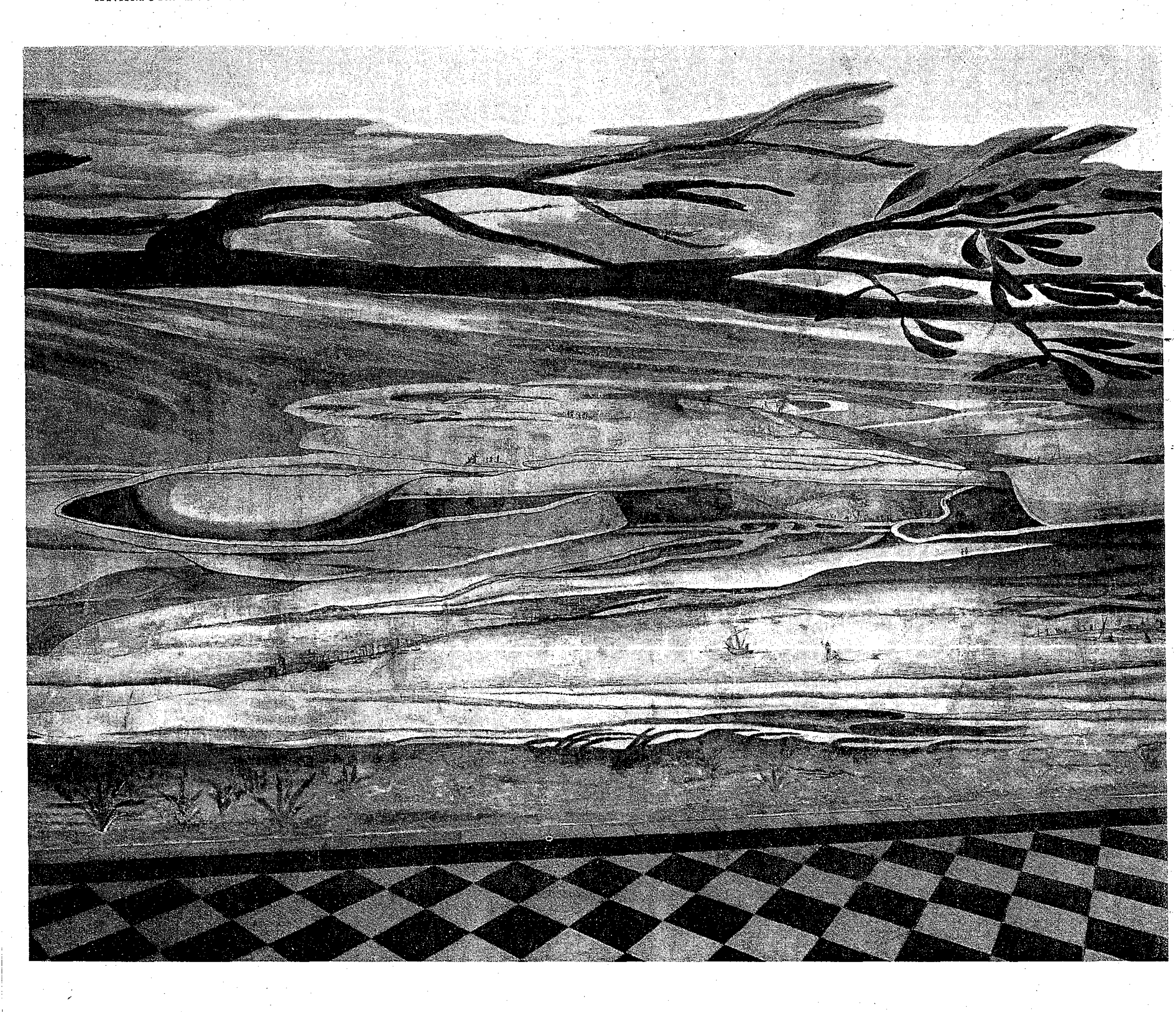
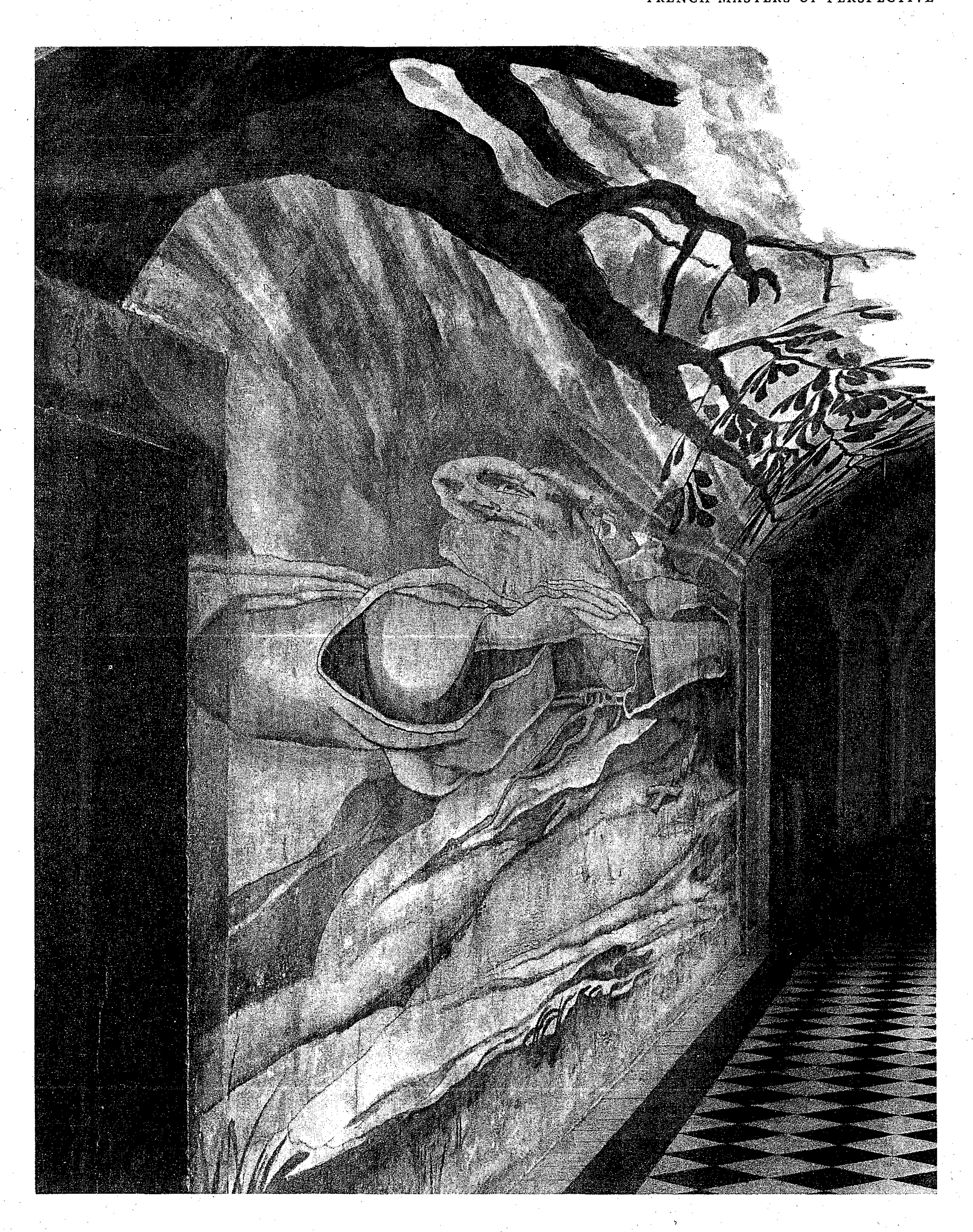


FIG. 38 Emmanuel Maignan: St Francis of Paola, anamorphic fresco in the cloister of S. Trinità dei Monti, Rome, 1642. Optical distortion and correction



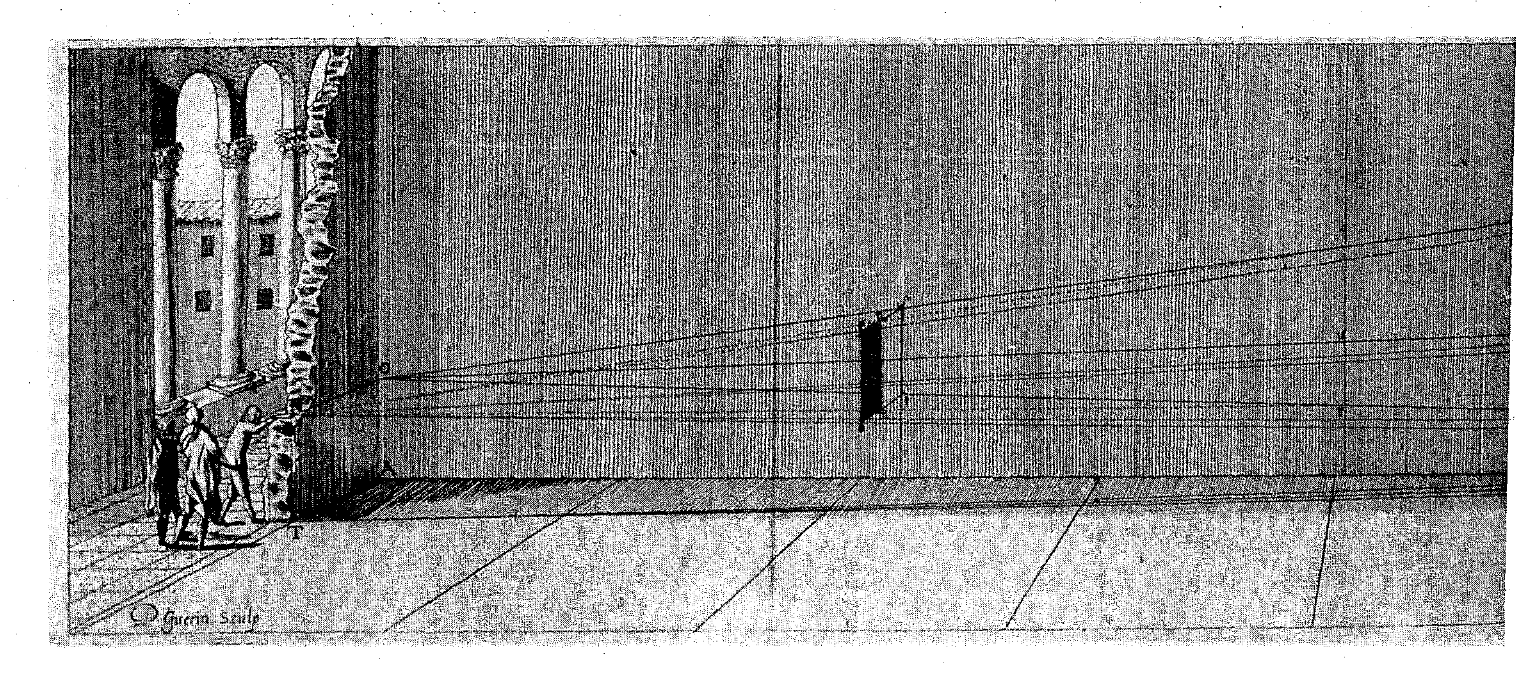


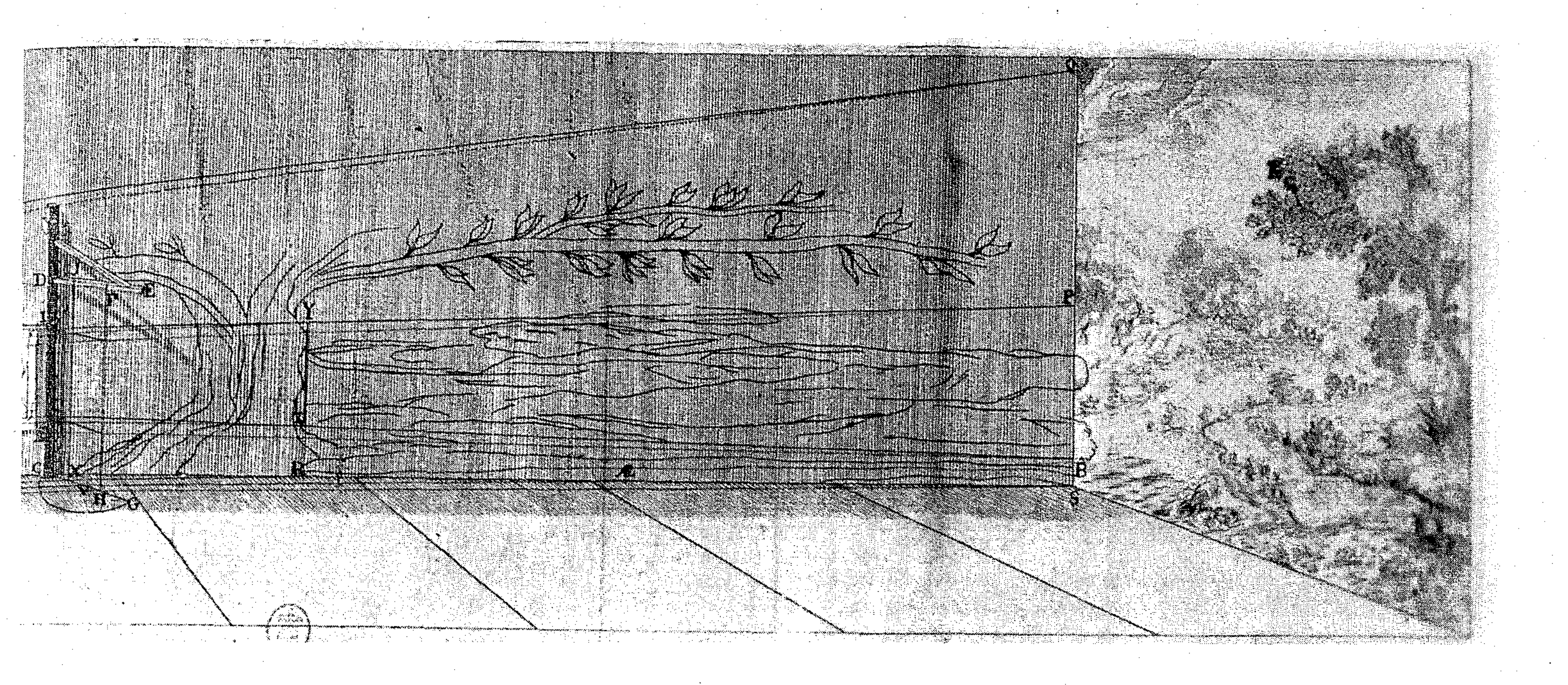
FIG. 39 Emmanuel Maignan: apparatus and methods of execution for the large anamorphic composition in S. Trinità dei Monti, Rome, 1648

frame the picture. A snail and a giant insect, placed on one of the gnarled tree trunks, introduce a marginal drollery.[19]

It is from these images that the figure of St. Francis of Paola kneeling in prayer emerges when one stands at the end of the gallery. The maze of roads which compose the lines give the drawing a particular solidity.

Extending along a wall, this astonishing picture was composed on a new principle. The use of a geometrical grid would have produced satisfactory results, but Emmanuel Maignan, author of an important treatise on sundials, wished to do even better. It was in fact with strings representing the visual rays emerging from the eye that he organized the whole picture as it is seen by the visitor on entering the gallery by a side door. Maignan's *Perspectiva horaria*, published in Rome in 1648, two years after Niceron's *Thaumaturgus opticus* contains a technical description of the method and an engraving to illustrate it (fig. 39).[20]

The system is a mechanical one, depending on a special apparatus like a miniature gibbet, fixed perpendicularly against the wall at a fixed distance from the viewing-point. On the horizontal bar D E, a movable string F H is fitted by means of a slipknot. The string's position can be changed, and it is kept upright by means of a weight. A gemstone is threaded on it in such a way that it can be slid along and stopped at the desired height. A shutter L K, with two hinges, on which the image to be projected is fixed, is hooked on to the upright of the 'gibbet'. Finally, a string N P, long enough to reach from one end of the gallery to the other, is attached in front of the entrance-door at eye-level. This completes the structure. It functions in three stages: 1 The shutter containing the image is folded back against the string



that holds the stone, and the stone is moved along to mark a precise point in the figure. II The shutter is then opened. The stone will then be in the air at the place corresponding to the point that it marked on the picture. This acts as a guide for the sighting. III The visual ray string is made taut, so that it first touches the stone and then meets the wall, fixing the projection exactly. By repeating the operation along the contours, one obtains the elongated transposition of the whole figure.

Such is this remarkable instrument. One is surprised to recognize in it Dürer's 'window' (1525; fig. 64), and even more to see the use to which the device is put, serving not to arrange but to distort perspective.[21] The mechanics are the same: the frame (minus a stick), the hinged shutter, the strings – visual and sighting strings – later perfected by Accolti (1625).[22] The two transverse strings intersecting inside the frame have been replaced by a single string with a pearl' (Fr. Maignan's 'gemstone') which is adjustable in height. However the apparatus works in reverse. In Dürer's drawing, the object is set in front of the 'window' and it is on the hinged panel that its contours are marked with the aid of the visual string. According to Maignan, the subject is put on the shutter and is projected onto the surface in front of the frame. Reconstituted in every detail, one of the first known instruments of perspective is revived in the mid-seventeenth century by a French Minim, who furthermore acknowledges the prototype which inspired him.

Niceron suggested that the perspective apparatus invented by a Florentine artist, L. Cigoli (1559–1613) should also be used in reverse. This he had discovered in the collection of Hesselin, the king's counsellor (a *Wunderkammer* in Paris), and had described as 'catholic or universal'. One should note in this connection that

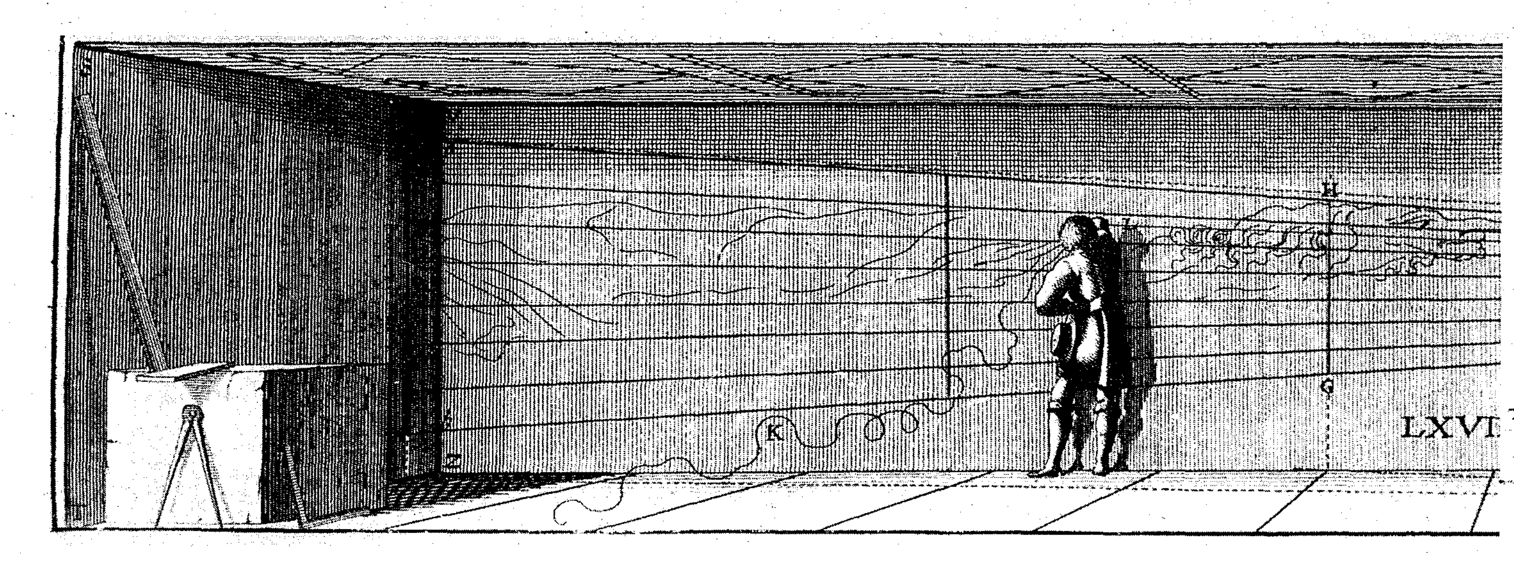
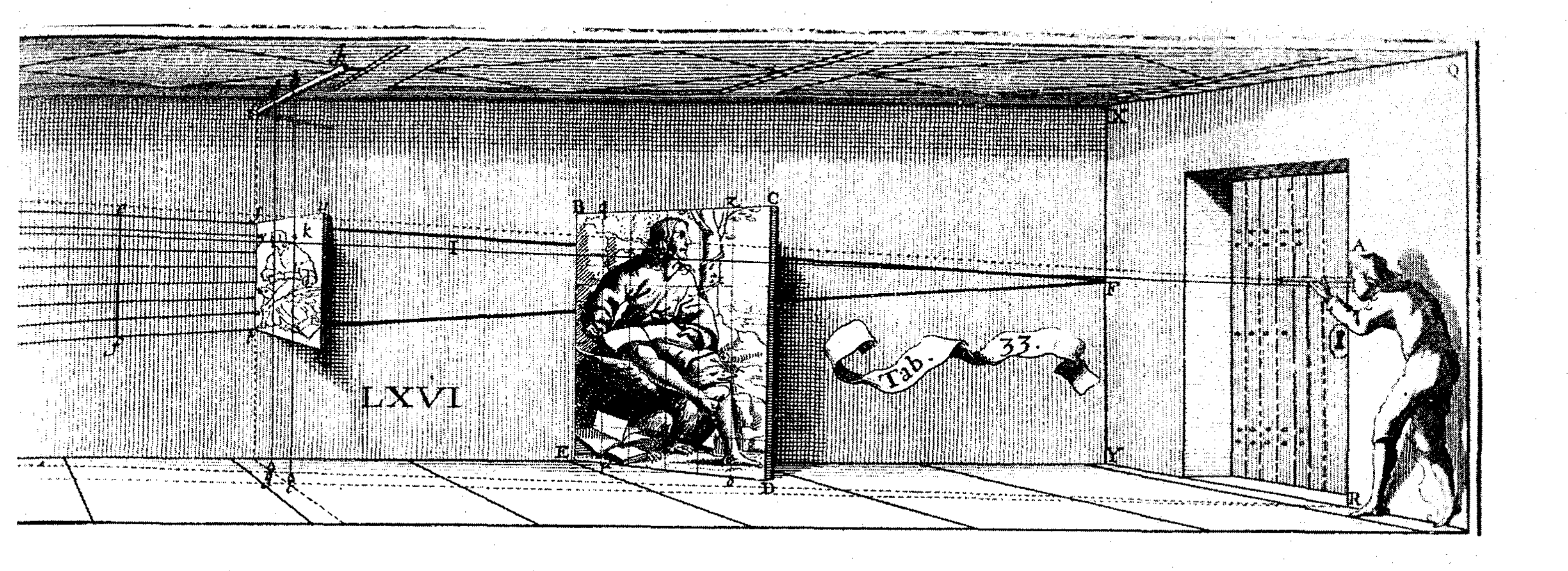


FIG. 40 J.-F. Niceron: *Saint John the Apostle at Patmos*, fresco executed in the Minims monasteries in Rome, 1642, and in Paris, 1644

Galileo was in touch with Cigoli and in 1612 wrote to him on the subject of an elongated picture.[23] He describes it as a human figure when seen from the side from a single fixed point, but when seen from the front as a chaos of lines and colours in which – with some difficulty – it is possible to find some resemblance to rivers, deserted beaches, clouds, lakes and ghostly forms. It presents a kind of allegorical poetry with a phantasmagoria of its own, in which the images and meanings flow out of each other and change according to the direct or oblique perspective of the concept. Galileo's comparison is valid for a large number of compositions which we have analysed and it provides an excellent definition of a poetic mechanism.

In the frescoes of *St . John the Apostle*, Niceron did not make use of the apparatus perfected in Florence, which was available to him, but rather of that of his colleague Maignan, without, however, abandoning linear methods. Always thinking as a geometrician, he used it not to bring back the image itself but just the outline. This permitted the simplification of the operation: the horizontal lines of the grid are drawn along the wall by means of lines led by a string fixed onto the Principal Point (F), while the vertical gradation is located with the help of another string that starts out directly from the Viewing-Point (A), in accordance with the Maignan system. As a result, the 'gibbet' is modified. Instead of a single movable string with a stone, there are several, which are weighted where the vertical division requires it and there is no 'guide'. To project this frame-work onto the wall, the procedure is as for an isolated point. Once the outline is obtained, all that is left is to draw the picture by following its successive elongations and expansions.

This was the hybrid technique, already described by Lomazzo with a more primitive frame, which was employed for the composition of *St . John the Apostle*



and reproduced in *Thaumaturgus opticus* (fig. 40). Niceron quotes the dimensions of the Parisian cloister: 'length of wall 104 feet, height 8 feet, picture of the Saint, 54 feet'. (The outline of a person 1·80 m. is 18 m. wide.) Entering the gallery one sees the fresco correctly, since the view-point is by the entrance, but the figure melts away as one advances along the corridor. Seen at close range, it is a landscape as in Maignan's fresco. But it is not however a monochrome painting. Niceron explains:

> I have followed the custom of the painters who clothe St. John in a scarlet robe, in order to paint on it several trees, shrubs, flowers, etc, which the people who walk along the gallery see directly, for the various adornments of the figures divert the spectators: but the painter must not include any item that interferes with the oblique view of this kind of Perspective.[24]

The two superimposed images, one appearing and the other disappearing as the gaze shifts, as in Barbaro's description and in Schön's plates, constitute a vast ensemble carried out with perfected procedures.

The system produces the same effect as the changes of scenery in Baroque *divertissements* and spectacles. The aforementioned Hesselin, counsellor and overseer of the king's pleasures, called by Niceron 'one of the most exceptional men in the world', was celebrated for his theatrical receptions. 'His house is filled with curiosities: one sees such beautiful mirrors, so many rare paintings and delightful pieces in high and low relief, so many fine books about every branch of knowledge, that one could describe it as epitomising Parisian collections.[25] When, in 1656, in his Château d'Essonnes Hesselin received Queen Christina of Sweden, who knew him 'through his singular reputation as one of the most skilful and gallant

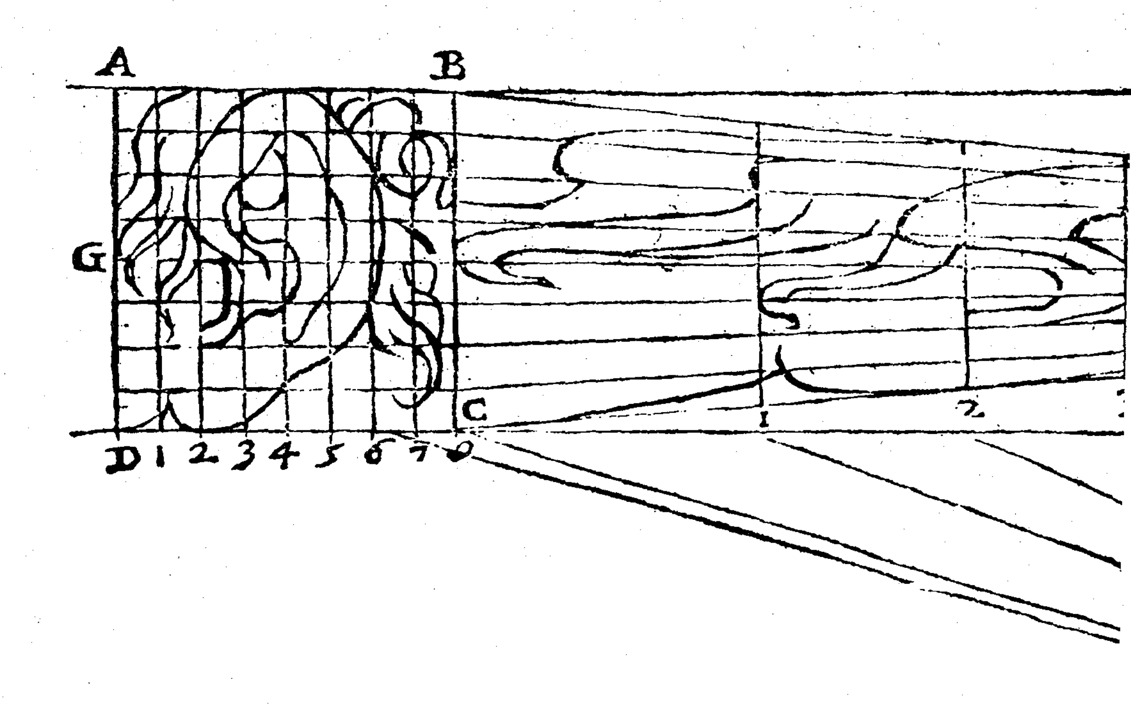
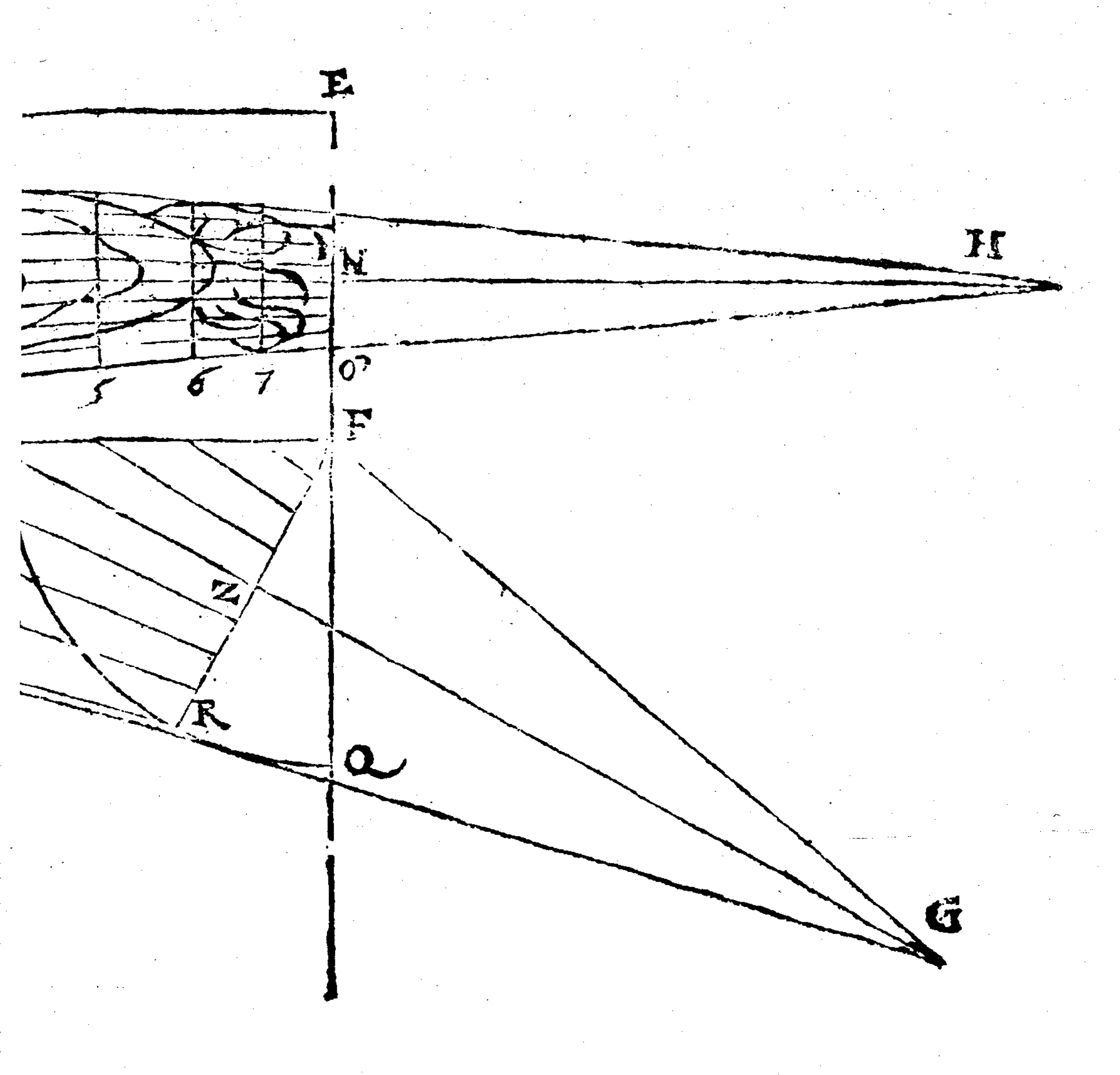


FIG. 41 P. Accolti: widened ear, 1625

men in France', he led her into an enchanted dwelling: everything was illusion, everything moved and was transformed.[26] The walls melted away, and one saw, in succession, vast halls, clouds bearing a city in flames, the chariot of Fame, 'a series of doors of several rooms, the first of which was guarded by two Swiss guards whom one took to be merely painted' but who moved away from the wall and executed a dance . . . , 'a cavern of extraordinary depth' which seemed to advance, revealing yet another cavern. By transformation and optical illusion, this unstable, fairy world unfolded in a continual anamorphosis. The *fête galante* in which visions were reincarnated and reabsorbed into other visions belongs to the same order of artifices as depictions of saints transformed into landscapes. The representation in the Château d'Essonnes was wholly based on systems of accelerated and false perspective, and it is quite possible that the illusions of appearance and disappearance were likewise produced with the aid of extended forms.

Hesselin shared with Niceron a passion for oddities and rare objects. His château, built around 1640 by Louis Le Vau in the Ile Saint Louis, was not far from the monastery of the Minims and Niceron often visited it. There, as we have seen, he



came across Cigoli's instrument which he was able to use 'in reverse'. He even dedicated one of his books to Hesselin.[27]

The chronology of Niceron's large frescoes can be established exactly. In 1638 he mentions only the leaning Christ of the *Descent from the Cross*, Daniel di Volterra's original in the Roman monastery and his copy in the church of the Minims in Paris, placed above the High Altar about 1632. The picture greatly impressed Niceron, so that one might well ask whether it was not curiosity about how it was done that urged him into research on the subject. His first fresco of *St. John* was first painted in Rome where he was in 1642 and where Maignan, interested in his researches – indeed, Maignan said himself that he had been led by his Parisian colleague to concern himself with these problems – proposed his own method. Perhaps it was a matter of competition and compromise. Niceron began work on the Place Royale cloister frescoes on his return to Paris. According to the *Annals of the Order of the Minims*, 'Fr. Niceron executed the anamorphic painting of *St. John the Evangelist on the island of Patmos* in 1644, and in 1645 began the *Mary Magdalene*.'[28] The work was interrupted in 1646 by a journey undertaken for

study, and in the same year Niceron died in Aix. This explains why the *Thaumaturgus opticus* does not deal with this second fresco. The *Annals* give us the additional information that the *Mary Magdalene* was completed in 1662 by Fr. Maignan, during a visit to the sister foundation. Since, however, Dezallier d'Argenville only mentions the drawing, Maignan's contribution was doubtless just a question of a retouching.

It was Paris that now became the important centre for the study and propagation of these optical contrivances. Even the Italians were to rediscover their own tradition through the influence of a Parisian monk and in a French monastery subsidized by the kings of France. Accolti's book, published in 1625, which shows an ear, whose elongation is determined by use of the visual ray method (fig. 41), as in Dürer's columns, mentions only a single example of anamorphosis: the portrait of the Grand Duke of Tuscany, Cosimo II, which can be linked with the first series of secret effigies of sovereigns. As late as 1642, Bettini, in his *Apiaria*, was still giving instructions on simple devices, even for catoptrics, for which in 1630 Vaulezard had established a rational geometrical system which will be the subject of the final chapters of this book.[29] After its diffusion in Flemish and Germanic centres, anamorphosis was now re-thought and developed by a French School.

But what was that strange monastery, founded by Marie de' Medicis (whose first cousin was in fact portrayed in a picture with 'magic' perspective) where above the High Altar a tottering Christ could be seen and where the Minims as they prepared for meditation in the cloister were confronted with pictures of saints that expanded and diminished endlessly as in a nightmare? Was it a retreat for *illuminati* obsessed by their speculations? No: it was in fact a Cartesian centre.

CHAPTER FOUR
Descartes: automata and doubt

The monastery of the Minims, founded in 1609 in Paris, close to the Place Royale (its buildings are now replaced by the barracks of the Gendarmerie, rue des Tournelles and rue des Minimes) was an important centre for scientific studies, often visited by Anne of Austria. According to Thierry, its library housed 26,000 volumes. The most illustrious men in the world of religion and scholarship met there and the foundation became an intellectual centre of European character. Its connections with Descartes were established through Fr. Marin Mersenne, theologian, mathematician and philosopher, thus continuing the Platonic tradition of the Renaissance which long remained its principal inspiration. In his biography of Descartes (1691) Baillet maintains that the two scholars had known each other at the Jesuit college of La Flèche. We next find them together in Paris. Mersenne who had entered the Order of Minims in 1611, settled there in the Order's new establishment. Descartes passed the winter of 1622–3 there and stayed there from 1625 until late 1628 or the spring of 1629 when he departed for Holland. It was in the setting of the monastery that there sprang up between them a friendship that was never to diminish. They corresponded regularly whenever they were separated.[1] It is certain that their relationship deeply influenced the spirit of the whole group. As it happened, questions of optical illusion and geometry were in the forefront of Mersenne's mind.

Apart from his great theological works, Mersenne wrote *Universal Harmony* (Paris, 1636), a work, like that of Salomon de Caus, dealing with music, a mathematical miscellany intended for preachers, a treatise on optics and catoptrics and a collection called *Amazing Questions or Scholars' Recreation.*[2] One realizes how close the nature of his studies was to the speculations of a Niceron. Moreover it was he who signed the theological approval of Niceron's *Curious Perspective* and revised the text of the posthumous editions.

Twenty-five years younger than Fr. Mersenne, his teacher and patron, Fr. Niceron was the youngest of the group. His precocity was remarkable. At eighteen, he was already considered 'very learned in everything to do with optics' by Jacques d'Auzoles of whom he made an anamorphic portrait in 1631 (fig. 114) and his research progressed rapidly.[3] A picture representing heads of Turks, but which, when seen through a multi-faceted lens, becomes a portrait of the Grand Duke of

FIG. 42 Figure representing Mount Tmollus with caverns hollowed out inside. Salomon de Caus, 1615

Tuscany, Ferdinand II (the son of Cosimo II de' Medicis), proves to us that Niceron was already a consummate master of his art at the age of twenty-two.[4] The young monk did not know Descartes personally but made use of his works and sent him his own book. In a letter dated 30 April 1639, Descartes mentions it to Mersenne and, in 1644, he sent Niceron his *Principles of Philosophy*.[5]

Emmanuel Maignan, who began by teaching philosophy at Toulouse, then settled at the French monastery in Rome, also belonged to this group. An intimate friend of Niceron and Mersenne, he was also an admirer of Descartes whom he praised on several occasions – according to a contemporary – and from whom he borrowed, without acknowledgement, 'whatever was finest and best'.[6] By a curious coincidence, all the men who were concerned with paradoxical perspective systems found themselves to some extent linked with Descartes. Scattered though they were, they belonged to the same circle, were connected with the Paris monastery, and pursued similar lines of research. Their works follow in regular succession; in 1637, Descartes's *Dioptrics* and his *Geometry*; in 1638 and 1646, respectively, Jean-François Niceron's *Perspective* and *Thaumaturgus opticus*, followed by a *Dioptrics*; in 1648, Maignan's *Perspectiva horaria*, and in 1651, Mersenne's *Optics* and *Catoptrics*, both written long before. These works all reflect a kindred spirit and, to a certain extent, contribute to a new philosophical movement. One even finds certain analogies of reasoning and association of ideas, among them the image of the automaton, which likewise finds its way into the demonstrations of Descartes.

Descartes, in fact, earlier than Niceron, deals with the automaton in his *Discourse on Method* (1637). He points out its similarities to animals, to machines, lacking souls or the ability to reason, such as a clock which is merely an assembly of cog-wheels and springs, and even to Man whom, however, he also contrasts with them. The automaton explains the workings of the body of living organisms:

> Which will seem in no way strange to those who, knowing how many different automata or moving-machines the industry of men can make, employing but few pieces compared with the multitude of bones, muscles, nerves, arteries, veins and all the other parts which are in the body of each animal, consider this body as a machine.[7]

The obsession with mechanical calculation which in Niceron dominates perspective systems, is present with similar emphasis in anatomical studies. The system is developed in Descartes's *Treatise on Man*, sketched out as early as 1634 but published posthumously in Leyden in 1662 and in Paris in 1664. In his preface to the Latin edition of 1662, Florent Schuyl describes the same mechanical wonders as are found in Niceron – the automata of Daedalus, the talking bronze head of Albertus Magnus, and so on. Descartes himself also knew of these machines; he and Niceron had the same source (Agrippa).[8] For his examples, however, he does not use these legendary masterpieces but a modern series.

> And truly, one can very well compare the nerves of the machine [i.e., Man] which I am describing to you to the pipes of the machinery of these fountains; his muscles and his tendons to the various engines and springs which serve to



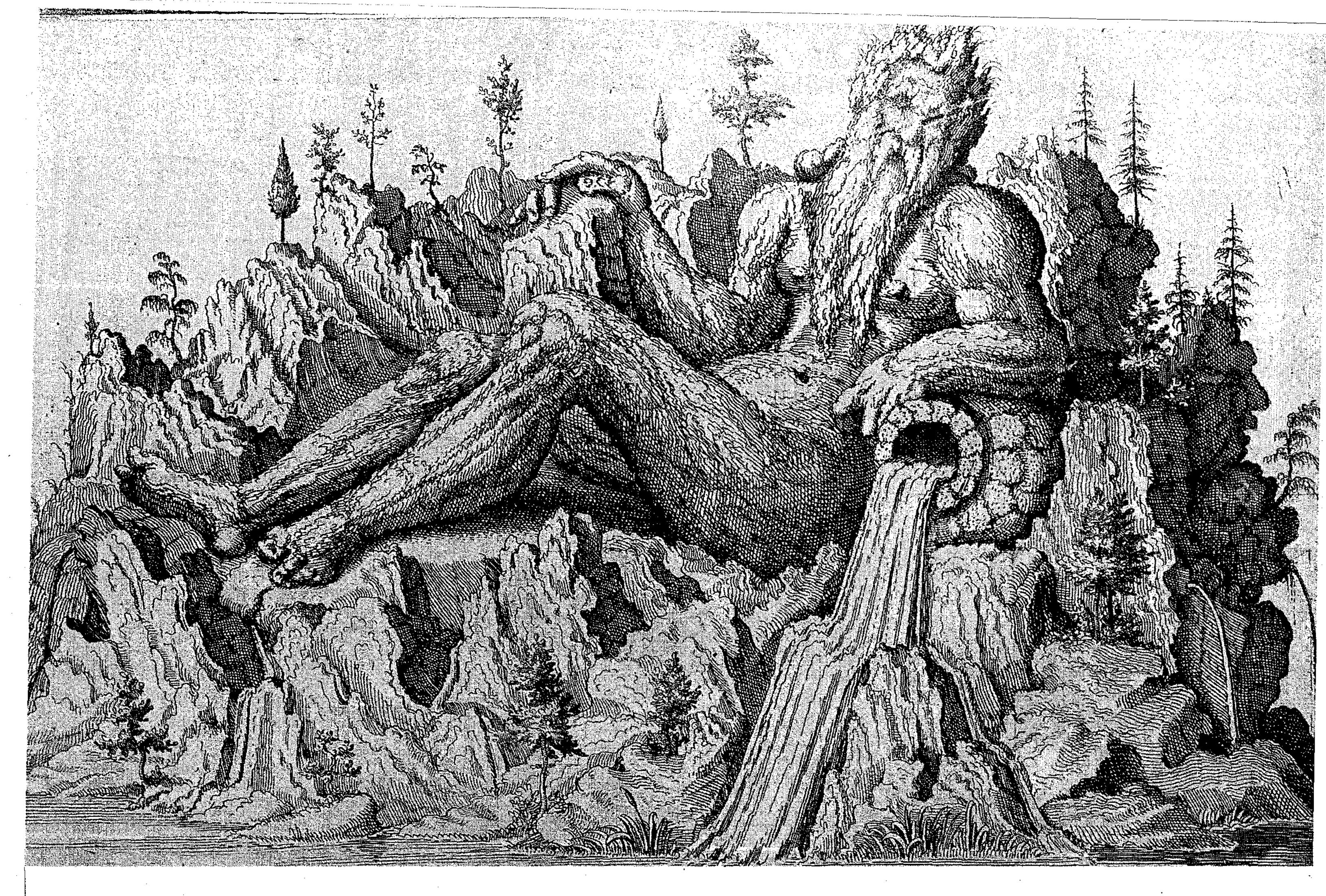


FIG. 43 Figure representing a river with caverns hollowed out inside. Salomon de Caus, 1615

move them; his animal spirits to the water which sets them in motion, whose source is the heart, and the cavities of whose brain are the outlets. [This of course applies to hydraulic machines but also Man.] Furthermore, breathing and similar actions, which are natural and normal to him and which depend on the functioning of the mind, are like the movements of a clock, or of a mill which the regular flow of the water can keep in continual motion. [Their actions are controlled by hidden levers.] External objects which, by their very presence, act against the organs of the senses and which by this means set up movements in several diverse ways, according to the arrangement of the parts of the brain, are like strangers who, entering some of the caverns containing these fountains, themselves, unwittingly, cause the movements which occur in their presence: for they cannot enter except by treading on certain paving-tiles so arranged that if, for example, they approach a Diana bathing, they will cause her to hide in the reeds and, if they pass on further in her pursuit, cause a figure of Neptune to move towards them, threatening them with his trident; or, if they move elsewhere, cause some marine monster to rise up and spout water in their face, or similar things will happen, according to the whim of the engineers who have made them.[9]

So we find ourselves in a garden with automata turning and moving in an appropriate setting, in keeping with a mythological scenario. What a strange image of Man with his conduit-pipes, cavities, grottoes in which dances of gods and of spirits of Antiquity are suddenly set in motion! How can we help but think of Salomon de Caus whose *The Reason of Moving Forces,* published as early as 1615, declared itself a Cartesian title? These forces, which are the four elements, the

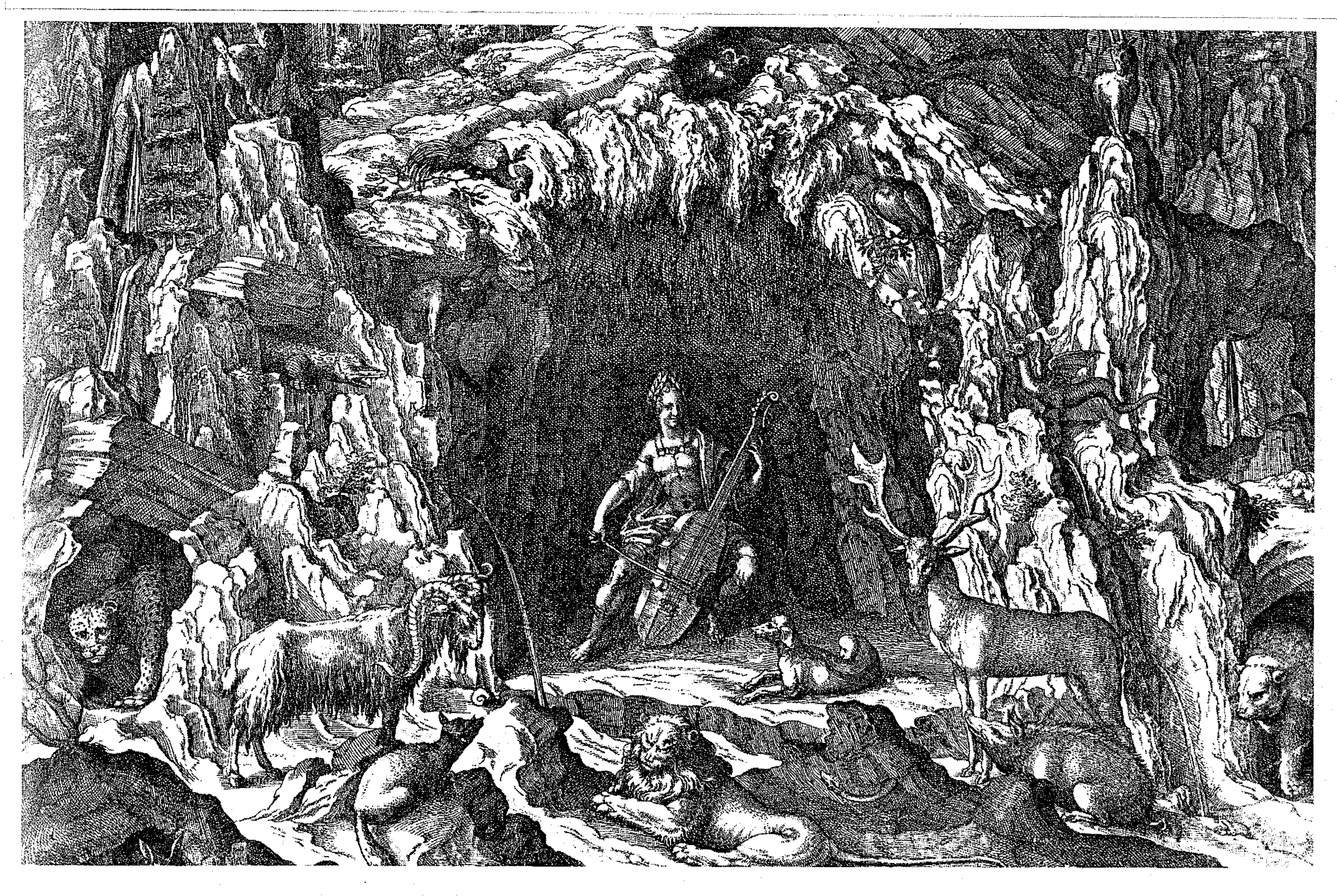


FIG. 44 *The Cave of Orpheus* 'which could be made in the preceding figure'. Salomon de Caus, 1615

first of which is water, link automata with a theory of the Universe and with Nature.

We rediscover 'the clock with the flow of a natural fountain', which Descartes uses to illustrate respiration, and all the systems of conduits and other arrangements which set the human body in motion, and even three statues with caves and fountains in their interior.[10] Salomon de Caus saw 'a huge Cyclops in whose body some caverns had been artificially concealed'; this was at Pratolino near Florence in the garden of Francesco de' Medici (the Villa Medici had been built between 1569 and 1584).[11] Montaigne likewise noted it in his *Journal* in 1580 as a 'giant which is three cubits wide at the eye opening, and the rest in proportion, through which a fountain gushed forth water in abundance'.[12] The colossus was Giambologna's *Apennine* which inspired two similar works by Salomon de Caus: 'A huge figure to which one could give the name Mount Tmollus [after the fable related by Ovid about the god of Mt. Tmollus, who, with Midas, was the judge of a musical contest between Apollo and Pan], and could construct caverns therein (fig. 42) as will be described in the following Problem' in which we see 'another drawing of a great rustic figure representing a River god [a giant, reclining on a mountainside] (fig. 43) in whose body some caverns can be contrived'.[13] It was the fashion. The countryside became peopled with giants with mysterious holes and caverns concealed in their person. These caverns similarly feature in de Caus's book. Problem XVII shows a drawing of the cave of Orpheus 'which could be made in the preceding figure' (fig. 44). Cartesian Man, with the ancient gods brought to life in his heart by a hydraulic mechanism, is complete in all his elements.

FIG. 45 *Neptune's Grotto*, Salomon de Caus, 1615

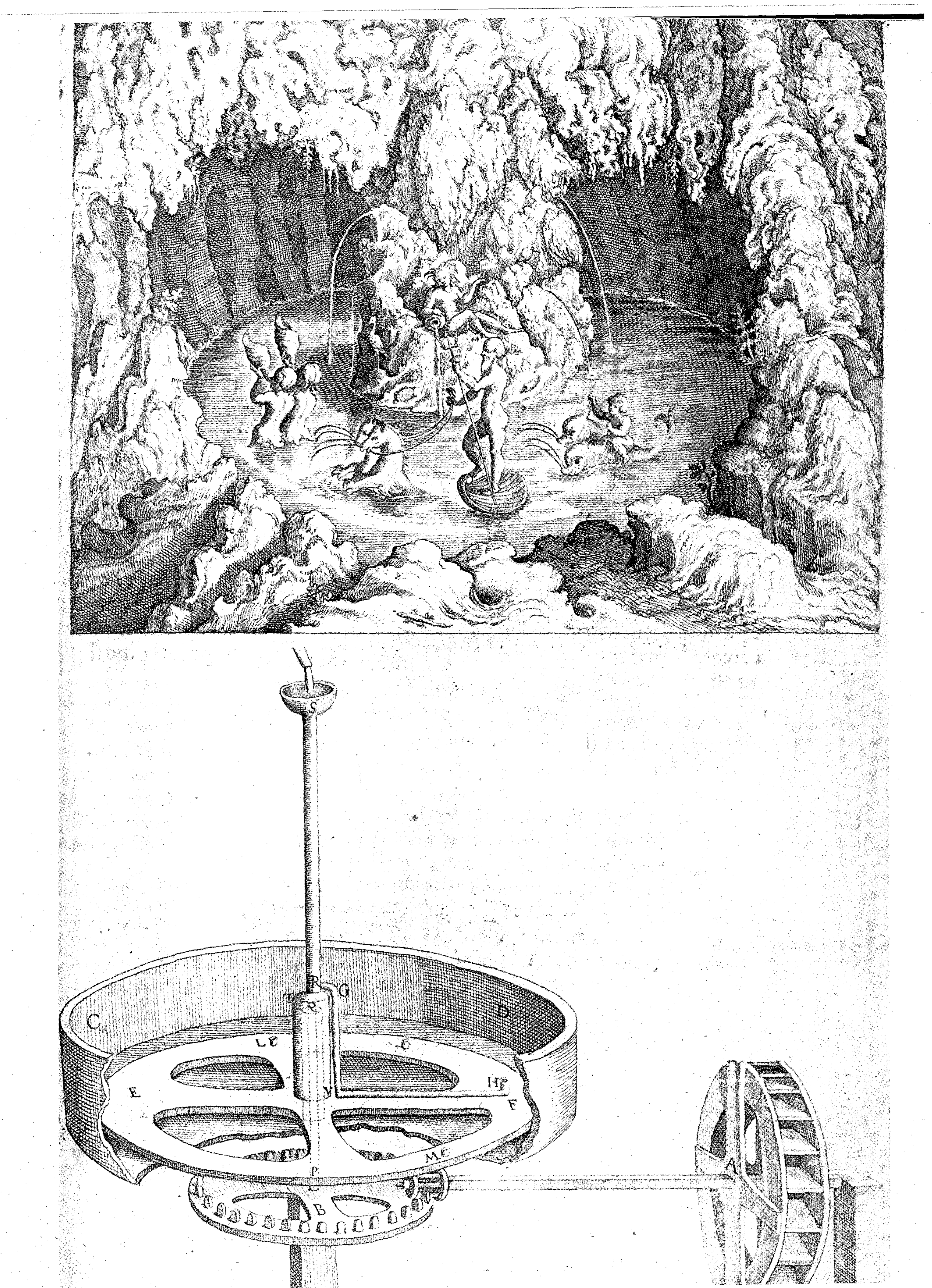
One scene described in Descartes's *Treatise on Man* also appeared in de Caus (fig. 45). In problem XXVII he explains the function of the machine by means of which the god Neptune 'will turn in circular motion round a rock with some other figures which will spurt water as they move'.[14] The text makes no mention of Diana, but a naked woman can be seen in the engraving sitting among the rocks beside the fountain. Neptune bears his trident and the marine procession spouts water in his wake. Except for a few details, it is the same scene. Descartes not only retains the general idea of the mechanical figures but repeats their arrangement exactly.[15]

Descartes had no doubt seen some contrivances made by Salomon de Caus, in the royal gardens in Germany where he had stayed in 1619 and 1620, but the majority of the elements of his demonstration are borrowed directly from de Caus's book. When Descartes went to Holland in 1629, he often saw the family of Frederick V, the Elector Palatinate and King of Bohemia who, with his Court, had taken refuge there following the events in Prague in 1620. Princess Elizabeth, the sovereign's eldest daughter, became his favourite pupil. He dedicated his *Principles of Philosophy* to her. *The Reason of Moving Forces* had been dedicated to her mother, the Electress Palatinate, wife of the man who had patronised and taken into his service the constructor of the automata. This proves that de Caus's treatise was available to the philosopher.

In taking his inspiration from these moving machines in his meditations on the structure and function of living organisms, Descartes moves outside the realm of logic into that of imagination; he thinks of the world as a theatre in which the secrets of nature are revealed through the medium of toys constructed by men. Thus it appears that Salomon de Caus, who alone among the exponents of paradoxical perspective had no direct link with the Mersenne–Descartes group, also made a contribution to the development of Descartes's mind. The strict logic of these automata had a profound effect on Cartesian thought. But their affinity to the fantasies of these scholars was also confirmed by studies on perception.

The problem of illusion in all its forms continually preoccupied Descartes. For him, as for Plato, there is a difference between reality and one's judgement of it, but in a wider sense. This difference does not only apply to works of art. Descartes also considered the works of Nature to be phantoms. This concern dominates his speculations. He had already formulated it in his *Discourse on Method:* 'I have always remained steadfast in the resolution I have made never to accept as true anything which did not appear clearer and more certain than the demonstrations of the Geometricians made it appear.'[16] This principle is the foundation of his research in many varied fields, not least in his examination of the sensations.

The *Dioptrics* (1637) sketches out the reasoning which Descartes returns to and develops further in the *Treatise on Man* (part III). Two experiments are proposed. One shows why we sometimes see double objects: if we touch a ball (X) with two crossed fingers (the forefinger T and the middle-finger R) these fingers 'make you think that they touch two different things, because they are crossed and forced out of their natural position' (fig. 46). It is a question of an illusion in which reality appears as other than it is, as in the figures that change according to an artificially fixed view-point. The second experiment concerning why objects seem to be in a


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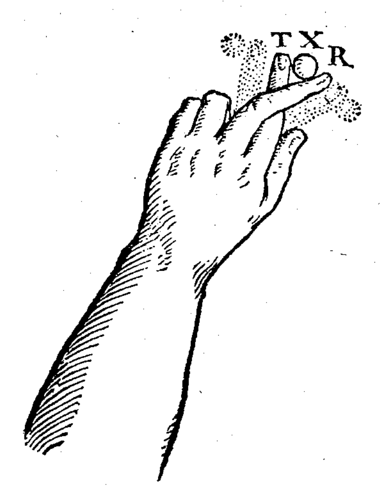


FIG. 46 Experiment with sphere. Descartes, *Treatise on Man*, 1662 ed.

different place from where they really are applies to a bent stick.

> If the rays or other lines, through the intervention of which the actions of the distant objects pass into our perception, are curved, the mind, which assumes them to be straight, will be deceived. For example, if the stick H R is curved towards K, it will seem to the mind that the object K which this stick touches is towards R [fig.47].

Perspective is falsifying the position and structure of objects. Descartes continues:

> And in conclusion, it should be observed that all means of knowing the distance of objects from us are uncertain . . . because the rays that emanate from their various points do not all assemble together exactly at the back of the eye, the example of perspective pictures shows how easy it is to be deceived: for, when the figures represented are smaller than we imagine they should be and their colours are a little indistinct and their features a little blurred, this makes them seem further away and larger than they really are.[17]

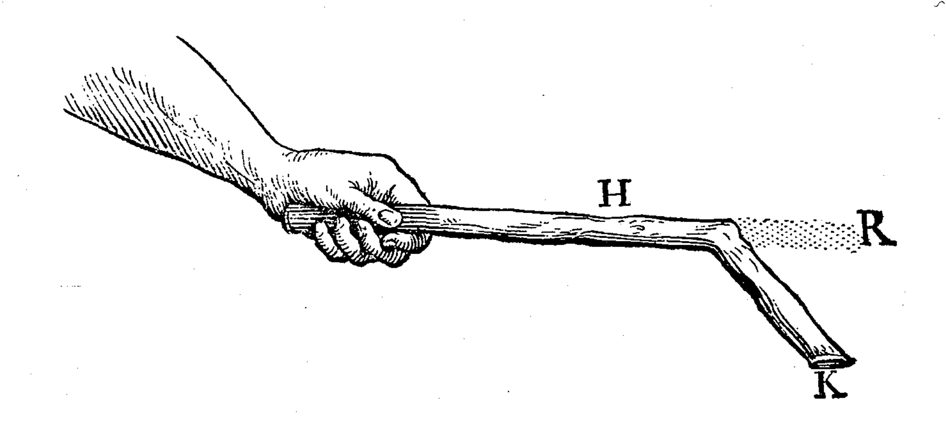


FIG. 47 Experiment with stick, Descartes, *Treatise on Man*, 1662 ed.

In discourse IV of the *Dioptrics*, Descartes enlarges on this analysis of visual errors. Things shown in copper-plate engravings are imperfect representations

> since, on a totally flat surface, they show us bodies raised and sunk at different levels and since, even according to the rules of perspective, they often represent circles more effectively by ovals than by other circles and squares more effectively by rhombs, and similarly with all the other figures: so that often, in order to be more perfect as images and the better to represent an object, they must not resemble it.[18]

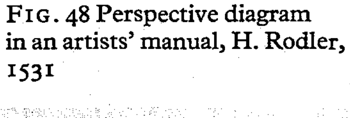
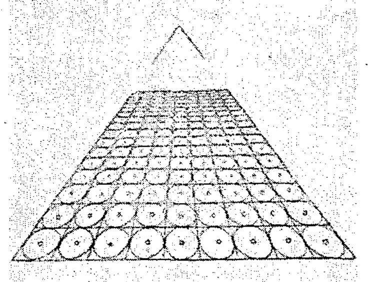


FIG. 48 Perspective diagram in an artists' manual, H. Rodler, 1531



This last passage could equally well be found in a Sophist or in Vitruvius, but the geometrical figures in question are those of modern perspective. Artists' manuals are full of these squares, frequently with circles inscribed inside them, represented by rhombs and ovals (fig. 48).* It is Alberti's *costruzione legittima*, Vignola's second rule, which furnishes the final proof of the falseness of the appearance of the physical world. Perspective is not an instrument for exact representations, but a lie.

*Known in fact in mathematics as 'Cartesian ovals'. *Translator's note.*

In all these cases, it is not a matter of fortuitous or occasional lapses of the senses. A whole series of curious phenomena in which objects duplicate themselves, are distorted and move, as in the hands of a conjuror, are assembled round some grand idea at the bidding of a metaphysical doubt. They make uncertainty certain, and in so doing bear witness to the necessity for the revision of ideas and values. They contribute to doubt. 'Everything I have hitherto accepted for what is most true and most certain I have learned from or through the senses: but I have sometimes found that the senses were deceivers, and it is prudent never to trust oneself entirely to those which have once deceived us.' (Things that one can call into question). All Descartes's demonstrations of the unreliability of our organs of perception reflect that concern which, in his *Meditations* (1641), he formulated as a doctrine of knowledge in which considerations also intervene on the vision of things and on artists' pictures – the real and the imaginary. The same teaching emerges spontaneously from the experiments of the perspective specialists of the time.

'Extravagant and unnatural foreshortenings' (de Caus), 'figures belonging to normal vision and which, away from the predetermined view-point, seem distorted and nonsensical, but seen from the proper view-point will appear correctly proportioned' (Niceron) – these are offered, in fact, as a demonstration of the same principle, and with the same searching after paradox as implied by the diversions with ball and stick.[19] The manipulators of perspective work with the same optical geometry as Descartes, extracting from it still more decisive and breathtaking proofs. Anamorphosis is as soft and flexible as the wax on which the philosopher also meditated.

Some speculations on optical illusion took on a strange character. Thus, Emmanuel Maignan compares the perspective mechanism which 'deceives our eyes' to the way our senses are 'deceived' in the mystery of transubstantiation or in the appearances of Christ transfigured as a pilgrim or as a gardener.[20] But these are miracles in the Gospels and not physical phenomena. The anxieties of the spirit are fed above all by uncertainties concerning things that are normally visible.

When Niceron constructed his 'curious perspectives', he did so in his own way, without transgressing the strictly technical framework, but he had been brought to it by influences which prevailed in his circle, and his works completely and brilliantly confirm the Cartesian reflections on palpable reality and on the divergences between the real and the apparent. Among the artifices he invented there was even one, causing hidden subjects to appear in a picture, based on a formula in the *Dioptrics*, published only a year earlier. The method consists of painting an extremely small inverted image on a ring or medallion, so that it is imperceptible.

> But putting your eye to the spyglass directly opposite this tiny object would enlarge its appearance to such a degree that one would see the smallest details very distinctly, while the rest of the painting would disappear from view, a scheme that would succeed admirably if one used glass or crystals of the form and shape prescribed by M. Descartes in Discourses 8, 9 and 10 of his *Dioptrics*.[21]

One is now no longer dealing with direct vision without an optical instrument, as

in distorted perspective. It is however still a game with forms concealed in other forms playing on errors of vision. Scientific experiments, tricks of printing, scenes involving automata and interchangeable pictures are found side by side, based on the same material and developing in the same direction, like some philosophical obsession with illusion. Anamorphosis, associated with these studies and experiments, takes on a new significance. The huge compositions in the cloister of the Minims, with saints taking shape and disintegrating, serve as a constant reminder of the scientific research carried out in the monastery and of the uncertainty of appearances which, in religious thought, corresponds to the idea of the inconstancy and the vanity of this world.

CHAPTER FIVE

The artists' quarrel: The Academy versus Desargues and Bosse

The development and propagation of the theories of perspective in a milieu of monks and scholars were disturbed by an artists' dispute which reveals both the intransigence and the passion with which they tackled these problems. A series of curious arguments brought Desargues into conflict with Fr. Du Breuil, and Desargues and Abraham Bosse into conflict with Grégoire Huret. At first the controversy did not directly concern 'distorted' forms, but in the end doubts were expressed about them too.

Gérard Desargues, the architect and mathematician from Lyons, author of a celebrated theorem, spent twenty-five years in Paris, from 1626 to 1650, and was Blaise Pascal's master. He was continually in touch with Mersenne and all the scholars of the monastery of the Minims, and his researches were on similar lines to theirs. After reading Desargues's *Practice of Perspective*, published in 1636, Descartes said of it that 'his inquiring mind and the clarity of his language are estimable.'[1] Du Breuil, who made compilations of several authors, also made use of this book with certain modifications – without acknowledging the source – and provoked a strong reaction. Desargues considered himself personally wronged and protested vigorously. Posters with indignant headings – 'Incredible Errors' 'Enormous Errors and Fallacies' – were plastered on the walls of Paris that January, and a pamphlet entitled *Six errors in the pages* was distributed among the public. Crowds of people were drawn into the argument and the conflict extended beyond strictly academic limits. Du Breuil immediately retorted with a pamphlet: *Charitable opinion on certain works and leaflets of Sieur Gerard Desargues.* The affair ended in a lawsuit. With Desargues discouraged, it was Abraham Bosse who undertook the publication of his work.[2]

Bosse's *The Universal Manner of M. Desargues of practising perspective* appeared in two volumes, one in 1648, the other in 1653, both under the same licence of 1643.[3] The second was entirely devoted to perspective on 'irregular surfaces'. The problem was presented from the Cartesian point of view: 'On what occasion does the representation take or not take the same form as the subject' (fig. 49). But it was a matter not of pictures but of distorted supports, that is to say various types of vaults and domes, inclined or undulating surfaces in which compositions were to preserve their exact appearance. The method derives both from retarded perspec-

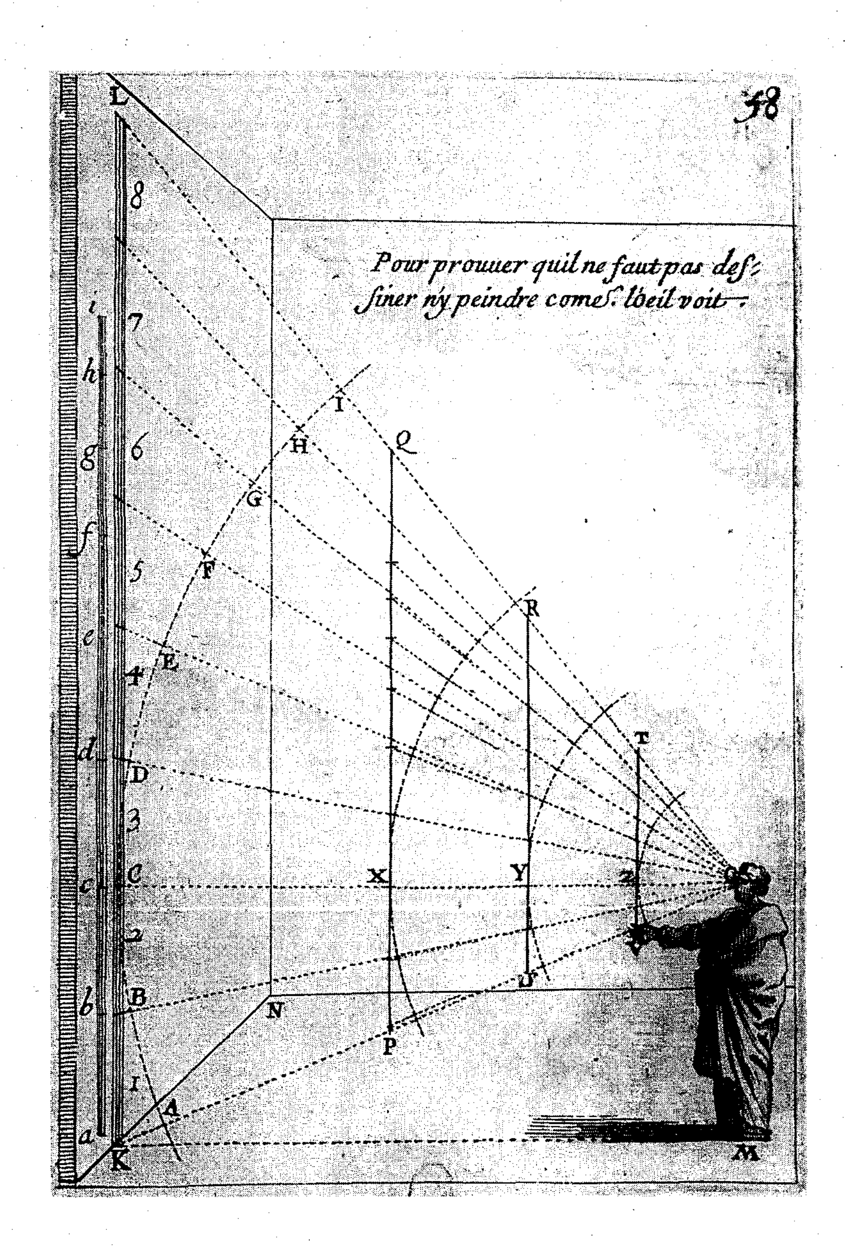
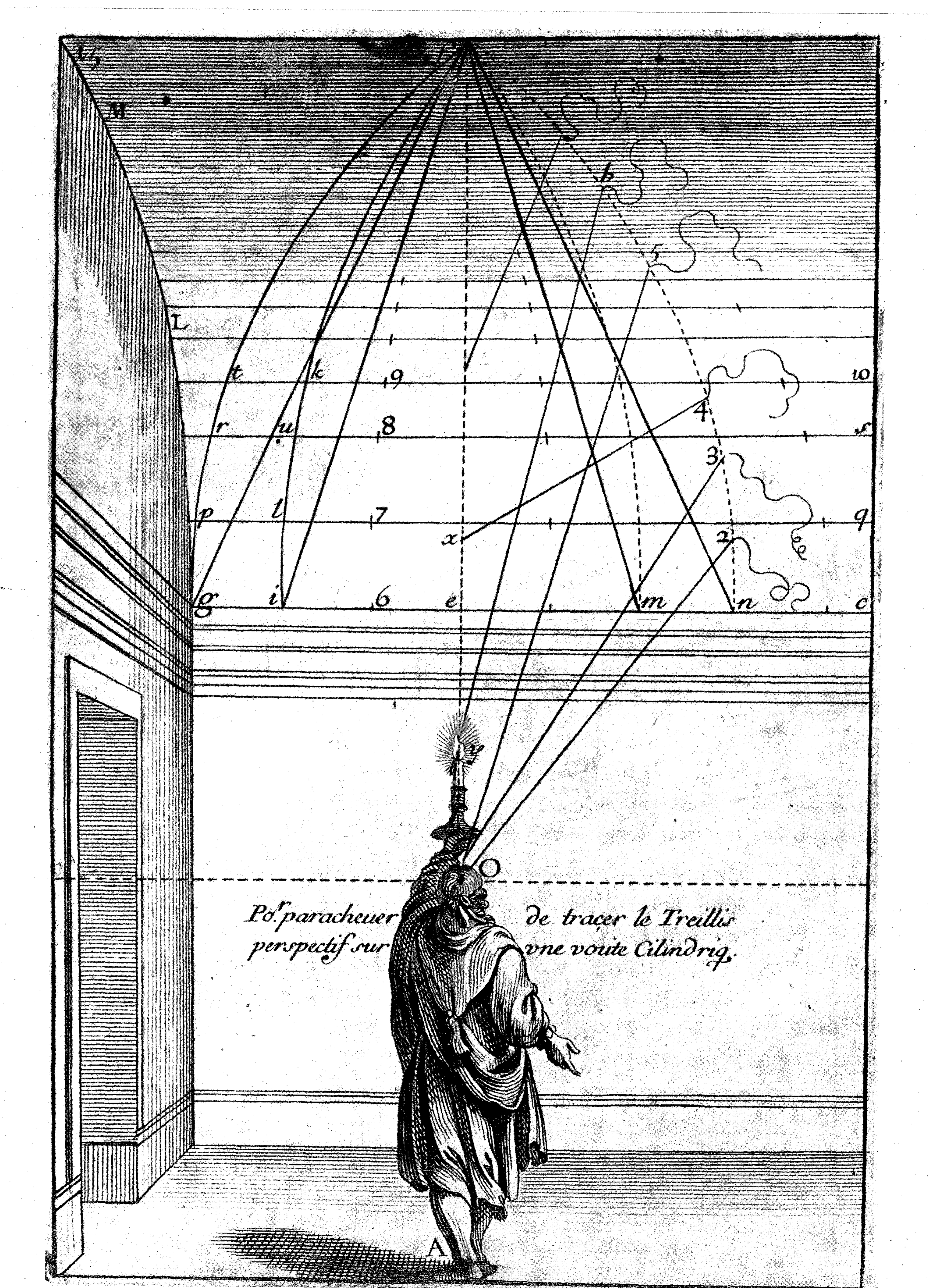


FIG. 49 Abraham Bosse: 'To prove that it is not necessary to draw or paint as the eye sees', 1665

FIG. 50 Abraham Bosse: perspective projection on a vaulted ceiling, 1653

tive, in which proportions are restored by calculating the visual rays, and from concave conical anamorphic pictures. 'If the subject is painted in its correct form on the horizontal cylinder as if it were on a gallery roof, it appears distorted, the lower parts are foreshortened, those from midway to the top do not change, or only slightly.' To counteract this distortion, the author proposes projections 'with strings, by means of candles or by a view-point given or found with such strings or by covering one eye or looking through one eye'. For a painting on the barrel-roof of a hall or gallery, the most practical method consists of placing under the vault a horizontal grid formed by stretched threads the shadow of which, projected by a light placed at the viewing-point, will produce on the surface the perspective 'trellis' (fig. 50). But there were also more complex and scientific formulae.

In proposing their methods, Desargues and Bosse did not anticipate effects produced with distorted forms. The operation is logical. The fact remains, none


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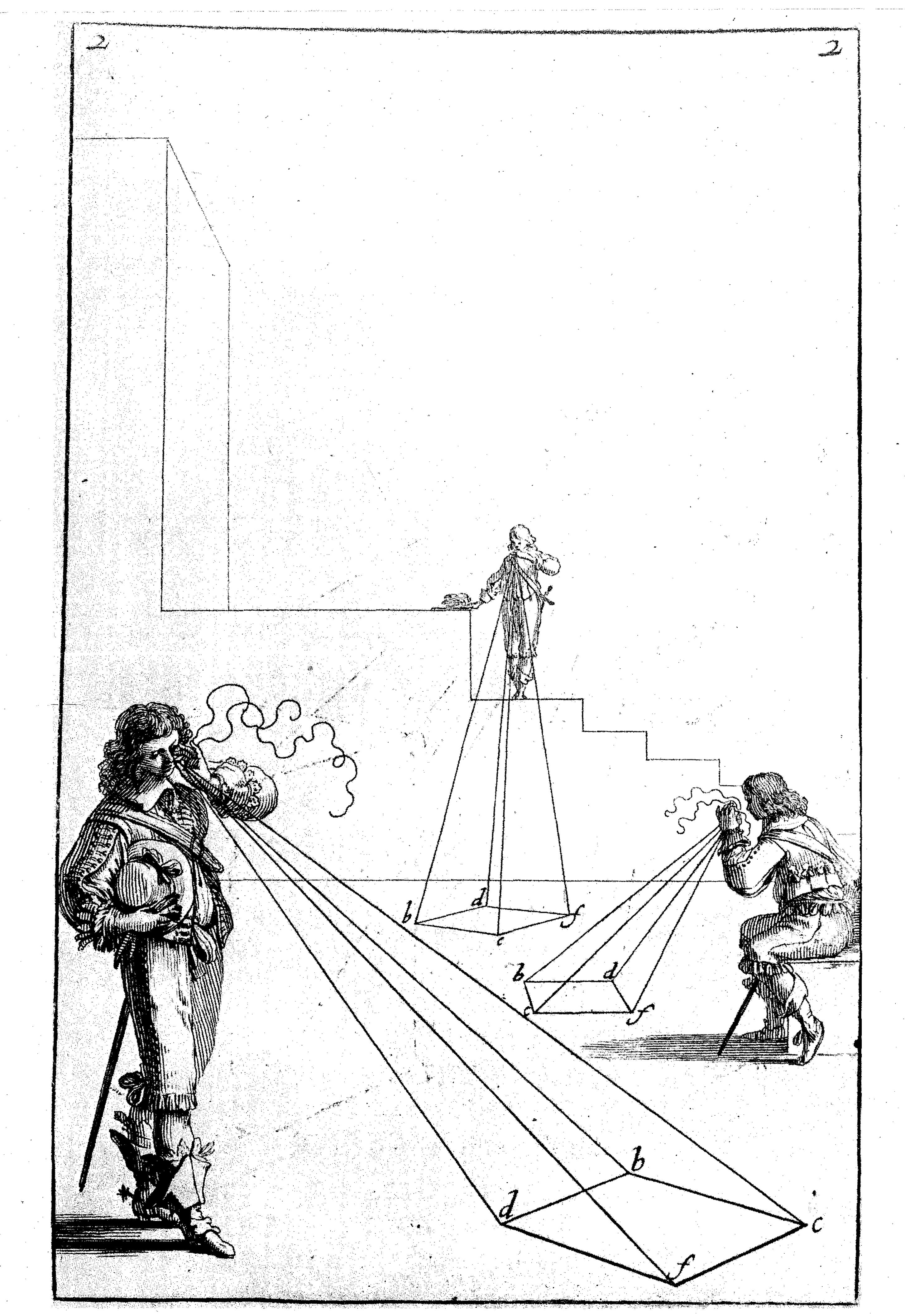

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FIG. 51 Abraham Bosse: *The Masters of Perspective*, 1648

the less, that it makes use of violent deformations, that its projection system is based on the principle which Barbaro recommended for anamorphoses, and finally that it is conceived in terms of vast architectural surfaces, to which the Minims – at precisely that period – were applying optical devices. Despite differences in the attitudes of these scholars, one finds common features in their researches and methods – and all have the same obsession. In one drawing in the *Universal Manner*, three gentlemen, completely absorbed, hold to their eyes strings representing visual rays and are deep in contemplation of squares traced on the ground (fig. 51).

The book aroused immense interest but was immediately subjected to strong attacks of which Bosse, after Desargues, had to bear the brunt. But this time the controversy involved the French Royal Academy which in 1648 had entrusted Bosse with the teaching of perspective and in 1651 had appointed him an honorary member.[4] All his theories were now described as 'mad, false, wrong'. In 1655 the attack was directed by Curabelle, then in 1660 by Charles Le Brun, who stated his preference for J. Le Bicheur's *Perspective*. In 1661 Bosse found himself excluded from the Academy. The conflict took on the aspect of an argument between the painters and the scholars. In 1670, Grégoire Huret, who had succeeded Bosse in his teaching post in 1663, resumed the attack with a book the violence and bitterness of which could hardly be described as academic.[5]

The formulae advocated by Bosse were treated as impracticable and 'most prejudicial even if they could be put into practice'. Bosse was said to be incompetent in this field: he obtained his theories from the deceased Desargues who had in his turn borrowed them from other authors

> such as Albrecht Dürer in Germany who was the first to produce perspective by mechanical means in his 'window' with the lute, and his Painter Glazier, appended to his Treatise on Geometry of 1532, from which it was taken to Italy by Vignola and Egnatio Danti who gave two methods for doing it (the first of which is mechanical like Dürer's and the other geometric) in the Treatise of 1583.

Huret asserts that these men are tiresome charlatans and goes on to say that Dürer's third method 'of portraying figures by squaring up' repeated by Barbaro and by Cousin 'is the worst of the three, since its foundation and aim are contrary to the rules of optics and of the art of portraiture'.[6]

All the great names fall under Huret's blows. We have moved a long way from cloistered contemplation and serene meditations on appearance and reality. The subject of perspective now unleashes hate and passion wholly unrelated to the theme.

By extending his offensive to embrace all the classical authors Huret arrives at the question of elongated depictions. One might well have expected him to annihilate them in this general massacre. On the contrary, the spokesman of the Academy of Colbert and Le Brun stresses the interest and importance of these devices. The systems are presented in the second part of the book 'which deals with speculative perspective; together with the most interesting and considerable questions which have so far been proposed concerning Portraiture and Painting,

with their solutions'. The author proceeds systematically, first studying geometrical perspective diminution in normal pictures.[7]

The problem is posed theoretically. If figures are to be seen, as they really are, through a 'sight' fixed in front of the composition, they must expand as they move away from the axis – spheres becoming egg-shaped forms, human heads becoming drawn-out profiles (fig. 52). Huret does not recommend this procedure. Looked at away from the viewing-point, the ordinary picture would look unpleasant in its distorted form, whilst a vast composition the full length of a gallery would call into question the very art of painting and portraiture. The depiction of such noble subjects as a battle, a procession or a triumph would resemble some monstrous mêlée. Human figures would look like bears standing on their hind legs or like victims of dropsy. 'And would not such pictures seem to have been painted in order rather to represent visions of sinister nightmares or witches' Sabbath revels, capable of evoking fear and gloom and even of causing abortion in pregnant women, than in order to depict natural and pleasing subjects in the normal way?'

In all these examples, the concern is not with anamorphoses in the accepted sense, but with optical adjustments such as those related by Pliny in the legend about Phidias or in Dürer's twisted columns.[8] Elongated pictures in which the subjects are completely annihilated by distortion do not have the same disadvantages, and they intrigue the spectator. Huret examines several methods in turn (fig. 53). He states that Marolois is of course mistaken when, like Vignola–Danti, he employs simple elongation in a rectangle without taking into account vanishing points. This method is illustrated by a woman's head similar to the figure in Bettini's *Apiaria* (see fig. 25). These, Huret claims, are crude devices, worthy only of inferior artists and not to be imitated. All those authors, headed by Niceron, who

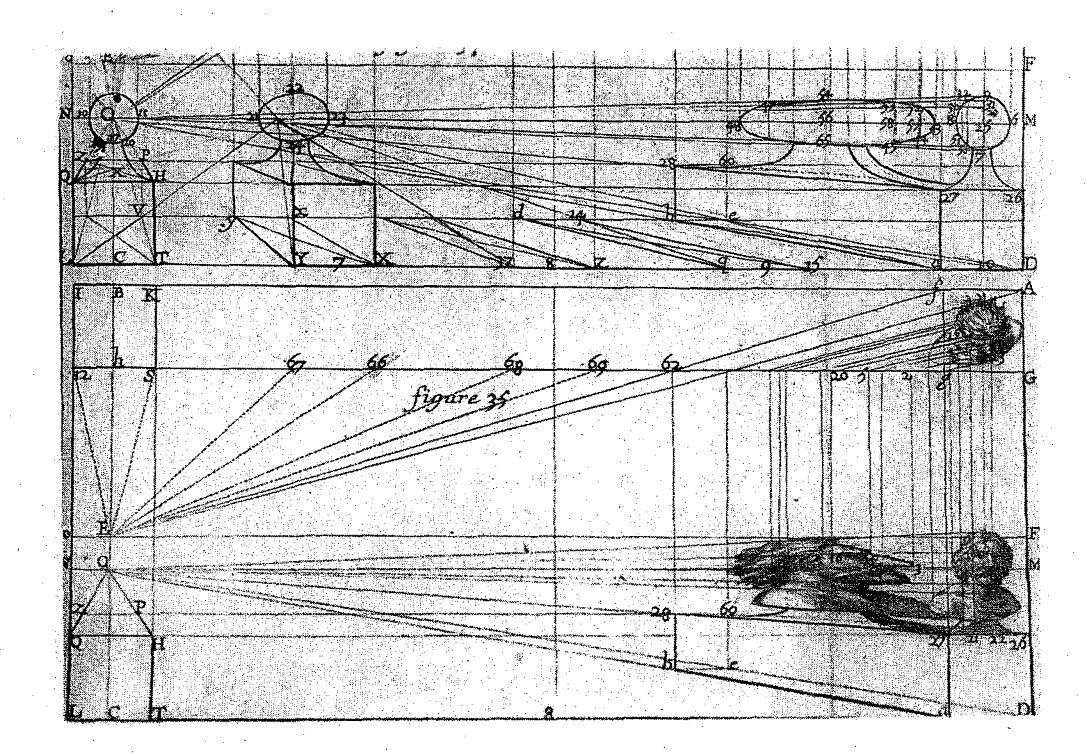
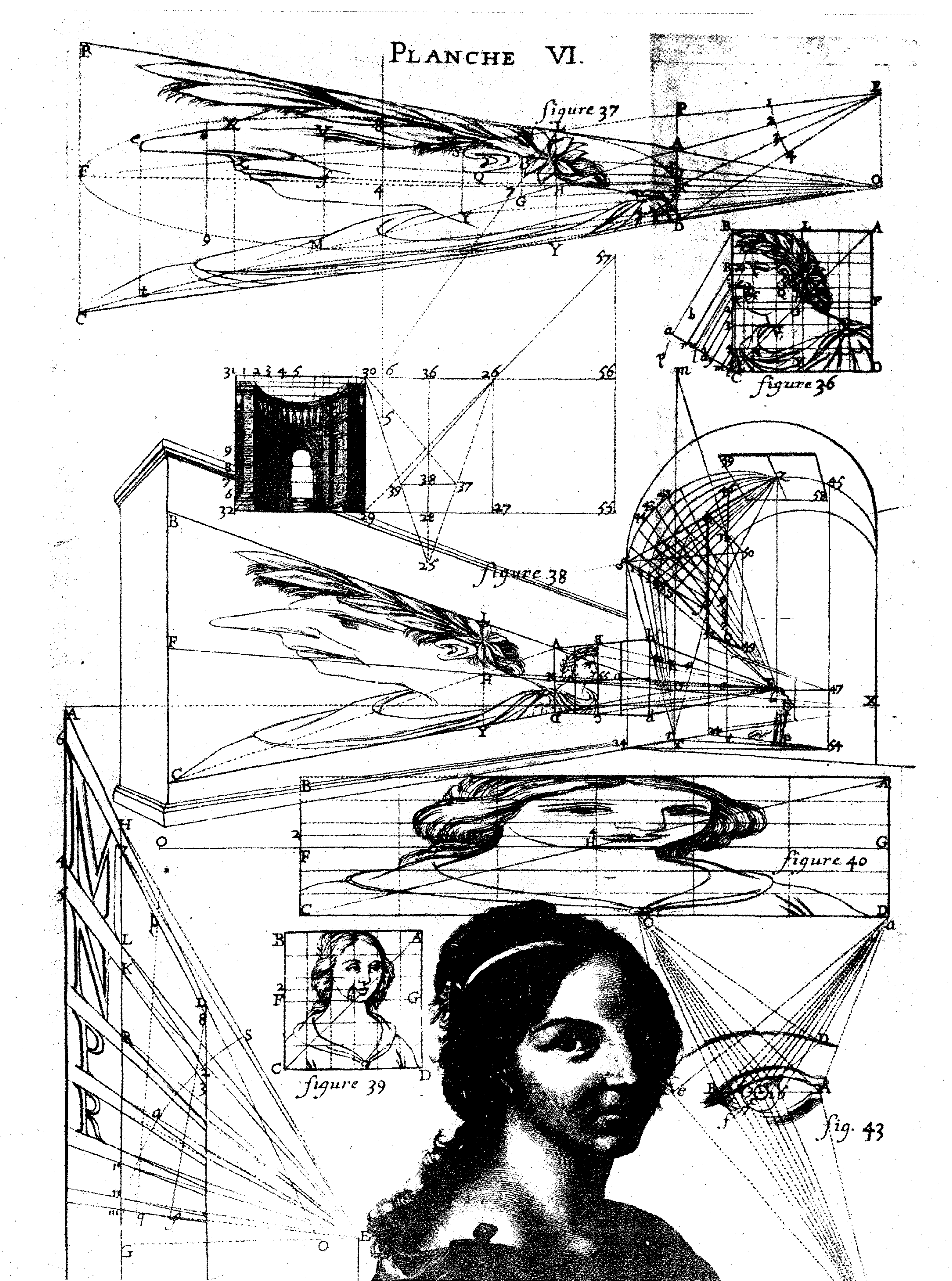


FIG. 52 Grégoire Huret: reduction in perspective of normal pictures, 1672

FIG. 53 Grégoire Huret: composition of elongated pictures, 1672

PLANCHE VI.



have dealt with these methods, have had no understanding of the question.

However, the method proposed by Huret himself differs very little from the procedures of the men he criticizes and in fact has the same result. Based on the direct use of the angle of vision, without a grid, it is a simplified version of Fr. Maignan's principle: the rays do not move successively round the entire outline of the figure to be projected but stop only at certain key points. Thus, on the drawing of a head, they touch the tip of the nose, the nape of the neck, the forehead, the top lip, the eye and the chin. The operation is carried out without the aid of threads, by shutting one eye. Vertical lines passing through these points complete the canvas by producing guide-marks, and all that remains is to sketch the proposed subject upon it. In the illustration a head and shoulders are drawn on a vast wall, whose length can be calculated from the silhouette of a man which provides the scale: some 20 metres, as in the cloister of the Minims.[9]

Huret also insists that the distorted image should be clothed with a normal one, as we have seen in the paintings of saints:

> In an elongated picture the head or half-figure is so violently distorted that it cannot be recognized unless seen through the proposed peep-hole: this means that it cannot produce any disastrous impression on those who see the picture with both eyes, freely from any direction, and who can be further diverted and amused by some kind of landscape that can be represented therein – with small shrubs, human figures, shepherds, sheep and other animals. These can be placed in the elongated hair and beard of the head, and in the folds of the garments. And all this will serve to occupy the spectator's gaze, until, when the picture is seen through the peep-hole, the elongated figure will be recognized at the moment when the violent diminution of the small objects, shrubs, figures, etc., causes them to disappear altogether.

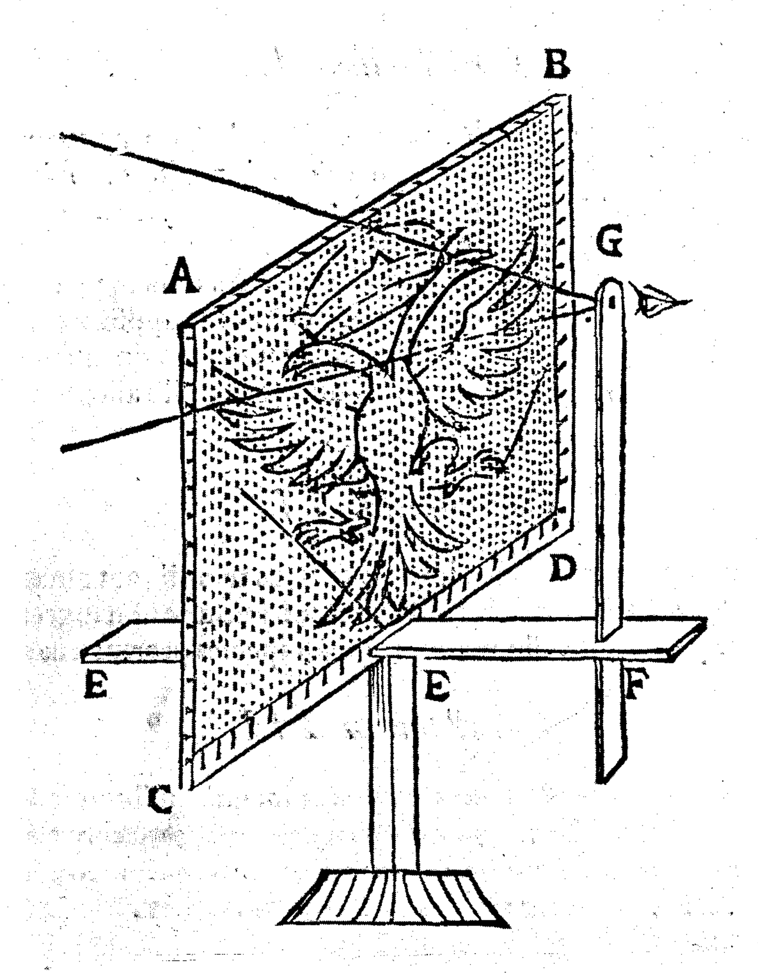
In this one recognizes the recommendations of Barbaro and Niceron, so abused in the same book. Involved in conflict between traditions and groups of artists, anamorphosis, repeated and disseminated for so long, especially as a pure science, resists these influences. Far from being rejected, it is admitted and methodically taught in its most fantastic aspects by a representative of the official school.[10] It almost becomes consecrated. But, in the meantime, Cartesian influences brought it back to the German centres from which some of the first examples of the technique had emanated.

CHAPTER SIX
German visionaries: Kircher and Schott

The road that led to the restoration of anamorphic perspective systems in the country of Schön passed through Rome the home of the Jesuit, Fr. Athanasius Kircher (1602–80) who was born near Fulda in Germany. He was a strange man, engaged in a wide variety of activities. A collector of curiosities and a scholar, he possessed a *Wunderkammer*. In 1633, in order to escape from the Swedish Occupation, he left Wurzburg, where he taught oriental languages and philosophy, spent some time in Avignon and finally settled in Rome. His vast corpus of work embraces Ancient Egypt, its language (1643) and its hieroglyphics (1654), China – whose civilisation was thought to be derived from Egypt (1667), magnetism and magnets (1630), music (1650), the celestial world (1656), the terrestial world (1657), the subterranean world (1664), light and shade (1646) and the mystery of numbers (1665). It is a mixture of pure and occult science, sense and nonsense, universal rules and anecdotes. Kircher was in contact with the French group of Trinità dei Monti as well as with the Minims of Paris. Descartes, who cared about his reputation among the German Jesuits, sought his friendship through the intervention of Fr. Mersenne.[1]

Perspective, when studied by a man of such wide and unusual ambitions, was caught up in the whirlwind of his syntheses and became involved in systems both real and supernatural. It was introduced in his *Ars Magna lucis et umbrae* (1646) in which rays are studied in their variety and manifold applications: cosmography, astronomy, horography, scenography, and so on.[2] In its optics, catoptrics, gnomonics, with which many Cartesians concerned themselves, the work reflects certain contemporary scientific influences; but elsewhere one finds the ancient astrological doctrines, horoscopes, and the magic of previous centuries.

All the problems of artificial and natural perspective, with their rectification and distortion by geometrical and mechanical means, are set out in detail in the section dealing with rays. But Kircher was principally interested in mechanical devices and in the distortion of forms. The apparatus which he claimed to have invented is similar to Maignan's, but the structure is more old-fashioned.[3] It consists of a frame on one upright with a transparent veil like that which 'covers the face of noble ladies', stretched over it. A movable 'sight' is arranged with pieces of wood so that it can be put at a desired distance and height (fig. 54). The instrument, described



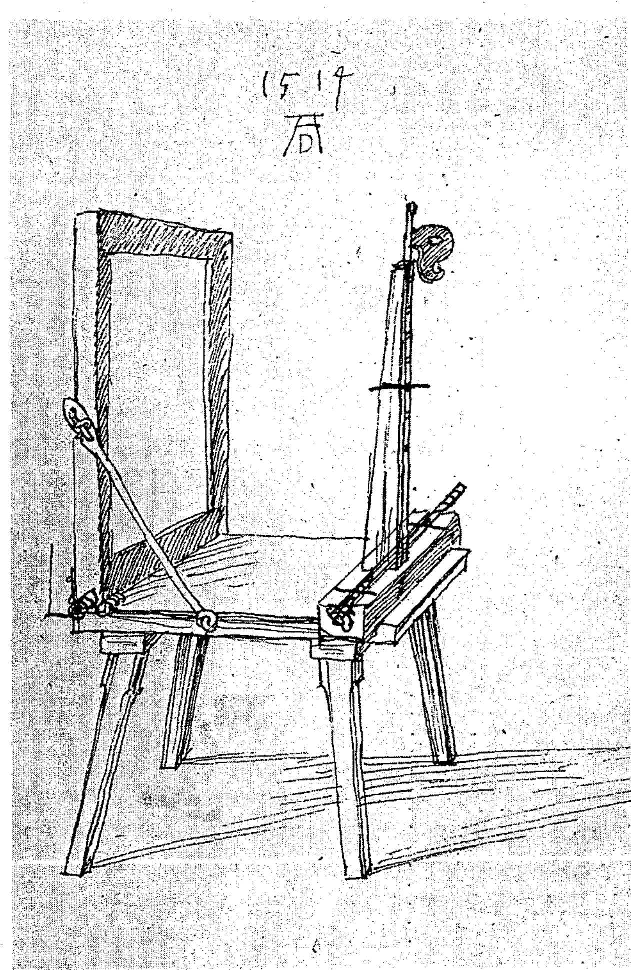


FIG. 54 The mesoptical instrument of Athanasius Kircher, 1646

FIG. 55 Dürer's 'window'. Sketchbook, 1514. Dresden Library, Germany

as 'mesoptical', repeats the elements, not of the 'door' used by Niceron but of Dürer's 'window' (1514–25; fig. 55), replacing the glass with a piece of fabric.[4] It represents a return to the earliest of all perspective instruments – Alberti's 'intersector' in which the frame had a 'veil of very fine, loosely woven threads, of any colour' stretched over it.[5] The treatise which describes it – *Della Pittura* (1435) – had by this time already run into five editions.[6] Furthermore, the same combination was introduced in similar terms towards the middle of the sixteenth century by Michelangelo Biondo, a Venetian surgeon.[7] Following Maignan's example, Kircher plunged still more deeply into the past; but, from this time on, the apparatus was to serve new purposes.

The mesoptical instrument was to be used for: I The examination of opaque and luminous rays. II Putting into perspective any object or body, an image or a statue, a building, a town, a forest or a mountain. III The gradation of clock-faces and sundials. It is particularly recommended for the transformation of images by light, by projecting (following Barbaro's method) their fixed perforated figures onto the screen and for the transformation of images by shadow, by projecting their silhouettes cut out in thick paper onto the screen.

The question of the diffusion of forms by means of oblique rays is thoroughly re-examined in the part of the book devoted to *Magia parastatica* (or representative

magic) a topic which Roger Bacon had already dealt with.[8] One finds in it a description of the decoration of vast architectural surfaces, walls, corridors and pavings, with elongated images, as envisaged by Lomazzo and Niceron. But Kircher goes a step further. Gardens can be arranged in such a way that, viewed from a given point, the trees and plants are transformed into animals which look as though they are painted in a picture; towns likewise can be built up of 'living' figures. The perspective instrument is no longer a static apparatus, registering visual rays. It becomes an active force, projecting around it worlds which are broken up and then recomposed as if by magic. Whereas the French Minims methodically pursued their experiments within the limits of logic, the German Jesuit was carried away by his speculations and extended his domain into the unreal. Even mountains and rocks could be reconstructed to resemble living beings.

Indeed, gardens with their trees and flowers assuming regular forms where nature is continually set in a system of carefully calculated perspective, offered excellent material for these arrangements, and the artifice could actually be carried out in practice. Descartes himself had already mentioned them in a youthful work (1619–21):

> In a garden one can contrive shadows which represent various figures such as trees and other things;
> Item, to trim hedges in such a way that from certain view-points they represent certain figures.[9]

But even here imagination ran riot. One anamorphic arrangement suggested before Kircher, by Mario Bettini, a Jesuit from Bologna, provides an example of these excesses. A professor of science and mathematics at Parma, Bettini was also the author of several plays, including a 'satirical–pastoral tragedy'. His idea was no less extravagant. It is the *Garden of the Instruments of Christ's Passion* (fig. 56).

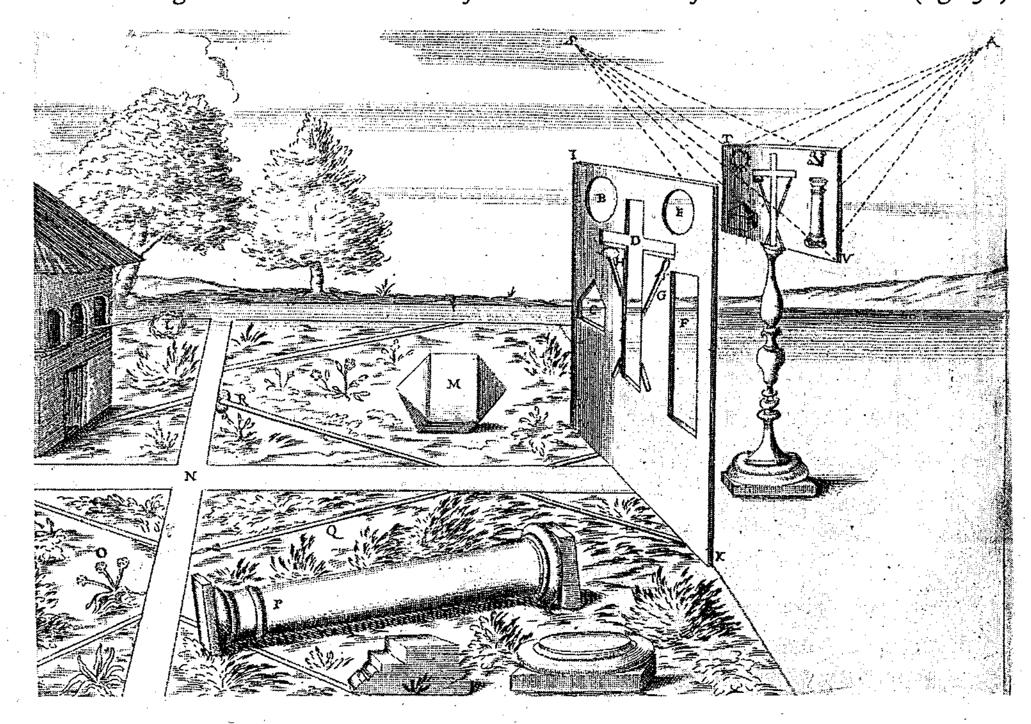


FIG. 56 Anamorphic landscape: *Garden of the Instruments of Christ's Passion*, Mario Bettini, 1642

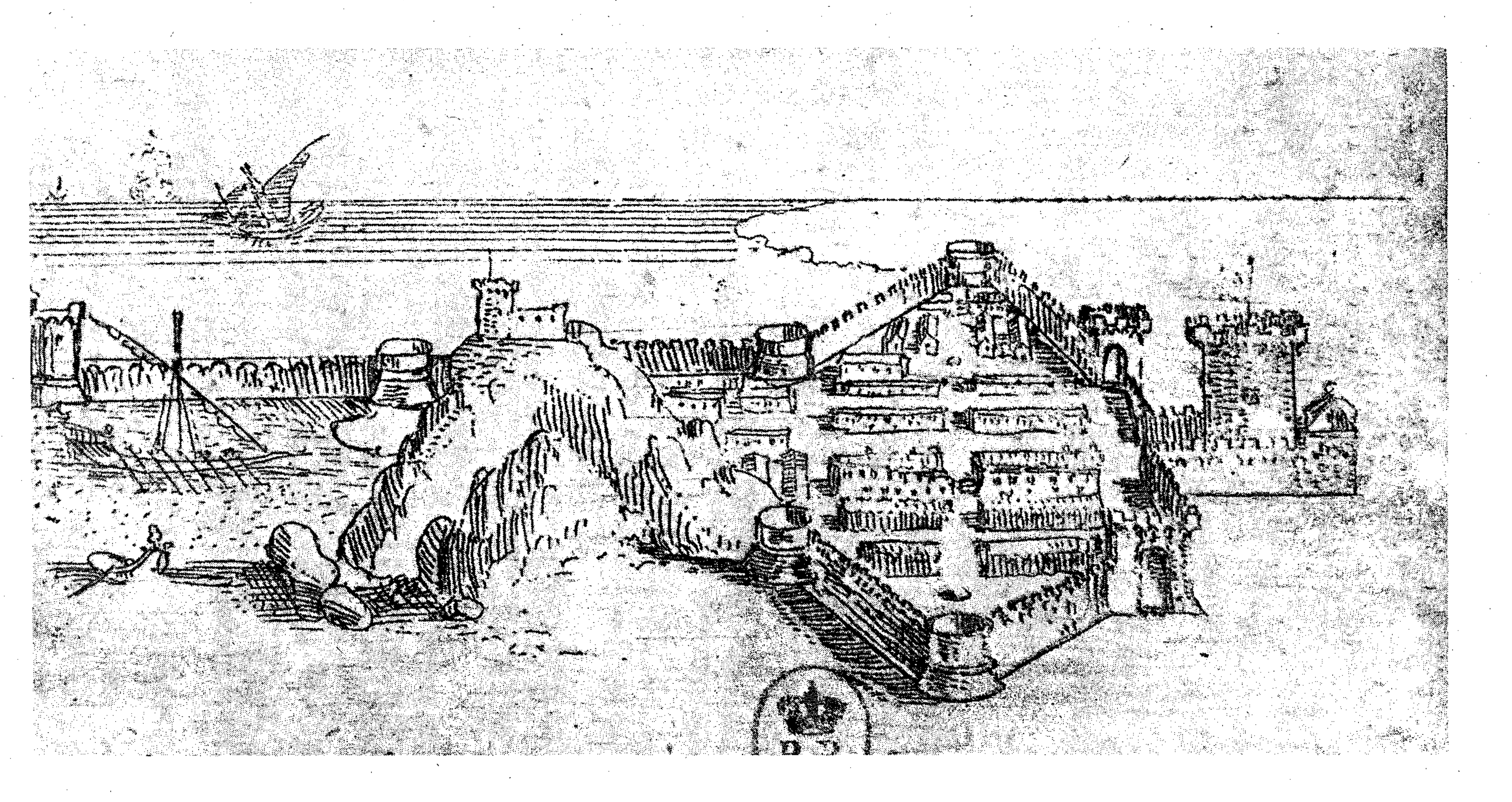


FIG. 57 Anamorphic landscape: *Anthropomorphic Seaport*, J.-B. Bracelli, 1624

The drawing appears in Bettini's collection of scientific mysteries *Apiaria*, published in Bologna in 1642.[10] The lawns are crossed by two broad intersecting paths and by slanting tracks. On the grass, facing a small house, are a column lying at an angle, and a strange polyhedron. From one of the windows of the house emerges a long pole bearing a crown of thorns. Three flowers are in bloom in the foreground. If one stands at a given point, the paths become the crucifix with the tracks forming two lances, the flowers and the geometrical figure are transformed into nails and into a tomb, the crown of thorns falls exactly into the place intended for it in the drawing, and the scourging-post seems to rear up. The great symbols of Christianity rise up from a flat field. The projection was to be made with the aid of a cut-out piece of paper with openings giving the positions and the outlines of each object, marked on the ground by the optical rays (lines of vision). The device is a development of that of Barbaro; it already foreshadows Kircher's frame but its use seems to present no fewer problems.

The extension of the device to towns and mountain scenery, envisaged by Kircher, is even more of an intellectual conception. These are subjects inspired by the imagery of popular prints with composite figures and a landscape showing men and gods in animal form, a genre which had been in circulation since medieval times.[11]

Among the *Bizarreries* (1624) of J.-B. Bracelli, who was active in Rome and Florence up to 1649, are a harbour and a village that look like recumbent giants (figs. 57 and 58).[12] One giant is stretched out on the seashore. His head is a castle

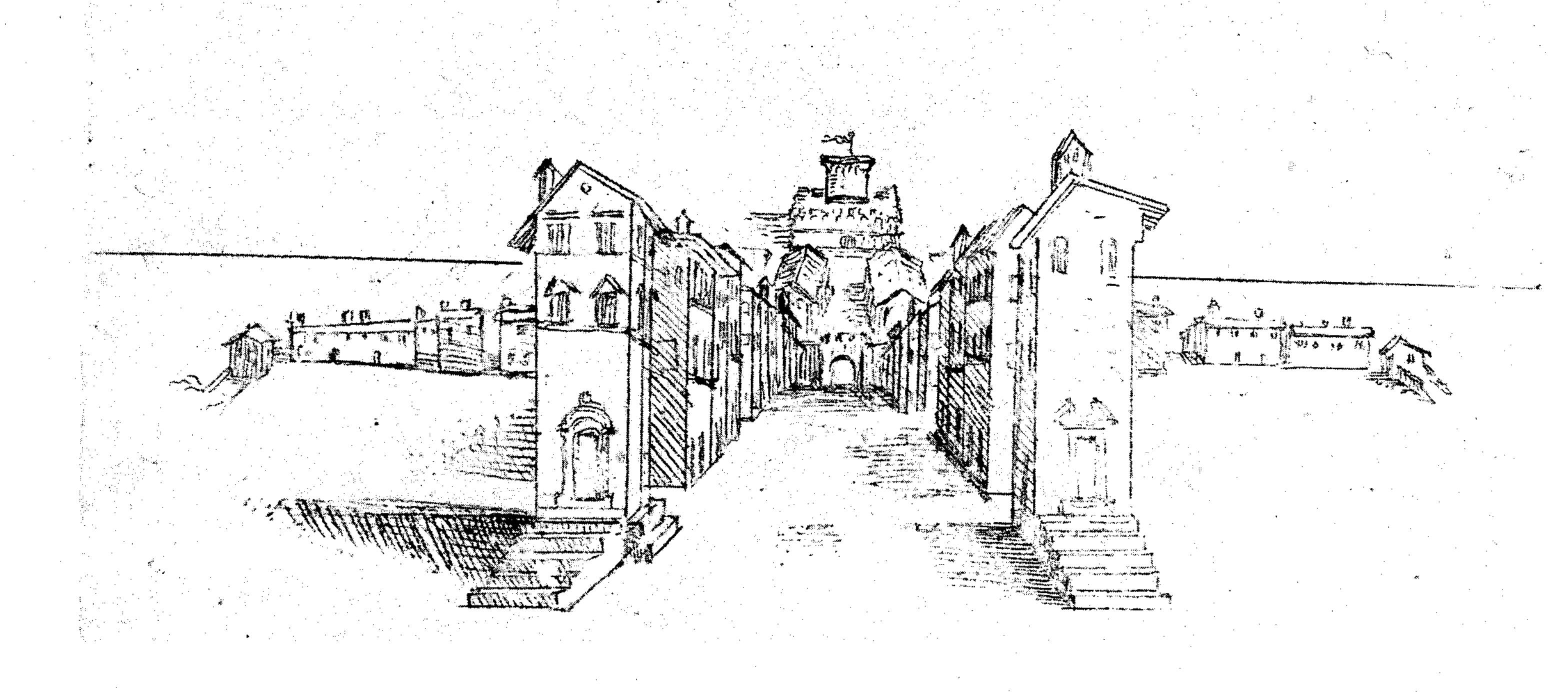


FIG. 58 Anamorphic landscape: *Anthropomorphic City*, J.-B. Bracelli, 1624

keep, his chest formed by the buildings within the curtain-walls which form the shoulders and arms; watch-towers mark the joints of the body. The right leg is constituted by a jetty, the left by two hills. Clothed in an architectural form as if in armour, the figure is a warrior, a sentry, resting by the water's edge. In the other illustration, the knees of the man outlined in the drawing of a straight street are bent upwards, his stretched-out hands cling to the ground on which he lies. A monumental gateway in the distance looks like a gaping mouth. The artist has built up these caprices, like the fantasies of Arcimboldi, with heterogeneous bodies and objects. Bracelli's book presents us with endless variations, conceived as a pure diversion, without any concern for how things behave in nature, whereas Kircher, who was certainly familiar with the work, regarded them primarily as optical projections: the human figure appears foreshortened but only from one viewing-point. Bracelli's example requires an instrument like the one which Kircher invented.

Although Kircher's treatise contains no illustrations of anamorphic cities, his directions for designing anthropomorphic mountains are accompanied by an engraving and a story. The story is that of Mount Athos, transformed into a man by Dinocrates, a Macedonian architect who worked for Alexander the Great. The sculptured figure held a town in his left hand, and in his right a cup that received the waters from all the rivers. This fable from Plutarch and Strabo occurs in the preface to the second book of Vitruvius from which Kircher also took the description of tragic, comic and satirical scenes as well as the passages on optical distortions for rectifying columns and their substructure. But in Kircher the legend

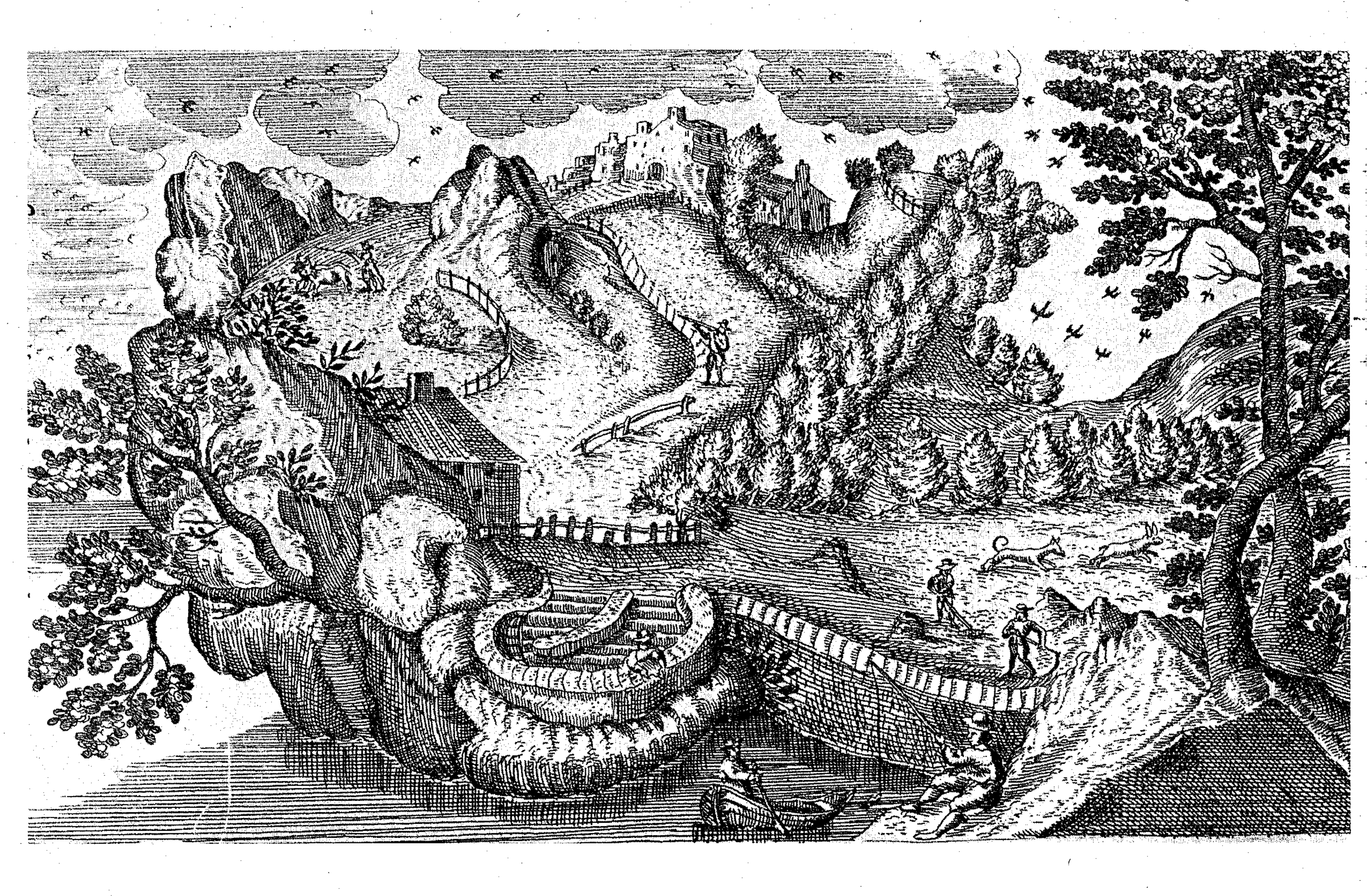


FIG. 59 Anamorphic landscape: *Campus anthropomorphus* of Cardinal Montalti's Roman Garden, c. 1590, Athanasius Kircher, 1646

is completed by a technical explanation: the giant in the mountain is nothing more than a huge anamorphosis, projected on an irregular terrain with the aid of a mesoptic screen.

It is not, however, Mount Athos that one sees represented in the engraving accompanying the description of these metamorphoses. Instead, in order to illustrate projections in a natural setting, Kircher shows a *Campus anthropomorphus* composed of a hill beside a lake (fig. 59).[13] Small houses are crowded together at the summit. In the middle is an open shooting-range with targets set up. A wood extends up the hill. In the lower foreground is the semi-circular wall of a quay. When one turns the picture, making the right-hand side the base, one sees a bearded head with the nose formed by the houses, the ear by the landing-stage, the eye by a target, the hair by the vegetation. It is a *Vexierbild* (puzzle picture) of the kind that had already appeared in paintings at the end of the sixteenth century, associated with the style of Arcimboldi.[14] We next find this device in a picture by Matthieu Merian (1593–1650), a native of Basle, and on a medallion of the *Wunderschrank* of Philipp Hainhofer (1632) which also included several anamorphoses.[15] The same contrivance is mentioned (this time on a panel) by an

Augsburg merchant who acquired it with various other objects at Ulm in 1610: 'A landscape on wood; when you turn it round, it is a man's face by Antonio Mozart.'[16]

The origin of this series is revealed by Gaspar Schott who, ten years later, repeated all the demonstrations of the *Ars magna*.[17] It was connected with a picture which was among the most valuable in Cardinal Montalti's gallery and which instead of showing an artist's improvisation was, ostensibly, the representation of the garden which the prelate had designed in Rome near the Baths of Diocletian in the time of Sixtus V (1585–90). No doubt there was at this period, as can often occur in nature, a landscape which suggested human features, and which they tried to enhance by various local arrangements, but only after first trying them out in a painting. It was the classic method which recommended the concealment of heads with water, mountains and rocks, used in reverse process, that inspired Kircher to employ a perspective framework to heighten the illusion.

But all this was merely a flight of the imagination. When Kircher returned to the realm of intelligible measurements, he fell back on the most practical geometrical systems: I The *costruzione legittima* for calculation of exact perspective. II Its extended and reversed forms, as in Niceron, for anamorphoses, substituting the German eagle for a head (fig. 60).[18] The grid extending over visual rays on which the distance is determined by a single diagonal line without doubt owes its origin to Niceron's earlier work, *Curious Perspective*, as the *Thaumaturgus opticus* had only just been published in 1646, the same year as Kircher's treatise. Except for projections on vast sites, all Fr. Kircher's schemes follow the same lines as the experiments and studies of his French colleagues who must have inspired him. If his allusion to the large mural compositions which had then been in existence for some time in the monastery of the S. Trinità dei Monti, Rome, is brief, this is because he wished to conceal his sources, since he presents the majority of the instruments and processes as his own inventions.[19]

The gap was to be filled by his pupil Gaspar Schott, who has already been mentioned. He too was a Jesuit and a native of the same region and had known his master at Wurzburg. Like Kircher, he left Germany during the upheavals of the

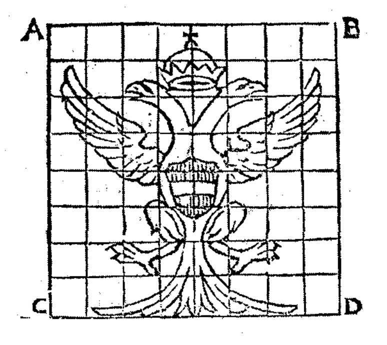
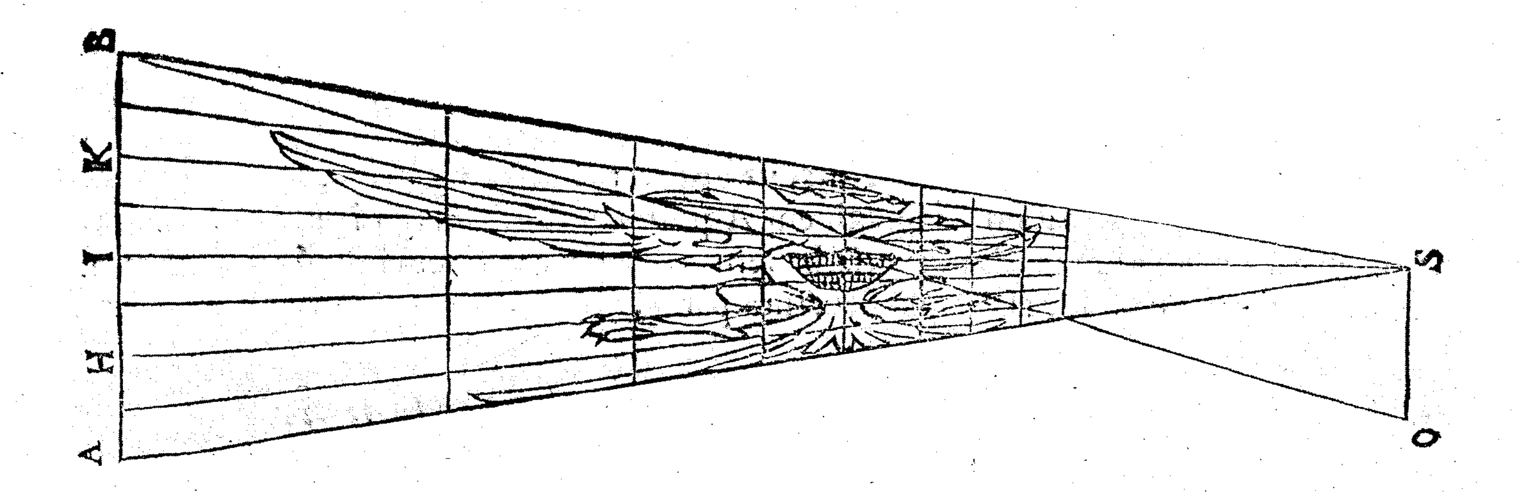


FIG. 60 Anamorphic diagram by Athanasius Kircher, 1646



Thirty Years' War and he took refuge in Palermo. After the Peace of Westphalia he returned to his own country to continue there the teachings of his former master. Schott's own writings were inspired by Kircher, but he allotted even more space to the occult element. Schott regarded all the curiosities of nature, and of technique as supernatural manifestations.[20] The marvels of optics, mathematics, physics and acoustics for him belonged to magic sciences. His *Magia universalis*, published in four volumes, first in Wurzburg (1657–9), then in Bamberg (1674–7), constitutes a detailed corpus. It could almost claim to be a cosmogony or theory of the Universe, reviving old beliefs and doctrines of the past.

Schott divides magic into three categories – natural, artificial and Satanic. According to a medieval legend, its origins are to be found in Zoroaster, the first 'white' magician of all time. Among illustrious magicians are Albertus Magnus and Cornelius Agrippa. As with Niceron in this context, it is a question of automata: a head that talks, and, in addition, moving statues and a machine that Schott had seen in Nuremberg, namely, a pyramid representing a miniature town, peopled with animated dolls – here a little barber with his razor, there an artist painting on a tablet. Everything takes place in the realm of the fairytale and of the toy, but they are infused with new life by faith in the miraculous.

Schott treats perspective as essentially anamorphic magic. *Magia anamorphotica* in fact accounts for one whole book of the *Magia universalis*.[21] It is here that one suddenly comes across the terms 'anamorphosis' and 'anamorphon' which had not occurred in the work of Kircher, although he employed an exaggeratedly technical vocabulary (in his superfluity of recondite words, inaccessible to ordinary people, he approached a hermetic language). It would seem therefore that the Greek neologism was introduced by his disciple.

Schott's work is a collection of all known procedures, more complete and explicit than the *Ars magna*, though Schott follows the general lines of that book and discloses its sources: Dürer, Niceron, Maignan. It represents a development of, or rather a return to, classical methods. Schott begins with geometry: *De geometricis imaginum deformationibus ac reformationibus in planis rectis*, in which one finds all the combinations of grids on rays with a single diagonal line (fig. 61), such as were given in the French treatises, with details about optics, anoptrics, and catoptrics. The geometrical projections on long gallery-walls are likewise credited to their originators. The method recommended is that of the *Thaumaturgus opticus*. The mechanics follow: *De mechanica imaginum deformatione in planis rectis* in which Kircher's mesoptic screen, Albrecht Dürer's 'window' and the apparatus invented by Emmanuel Maignan appear in succession.[22]

Kircher's apparatus functions in a similar way, projecting shadows, lights and optical rays, but in Schott's description we find new details about how to use it.[23] Thus, for gardens, an assistant will place stones on the spots struck by the visual rays which pass through the perforated outlines of the figure fixed on the screen. The stones will then be replaced by flowers, herbs, trees, streams and fountains. A window in a palace is suggested for the chosen view-point. Men, eagles and lions should be represented in the drawing. The image to be imposed on mountains and rocks should be the imperial eagle. In this connection Schott mentions not only

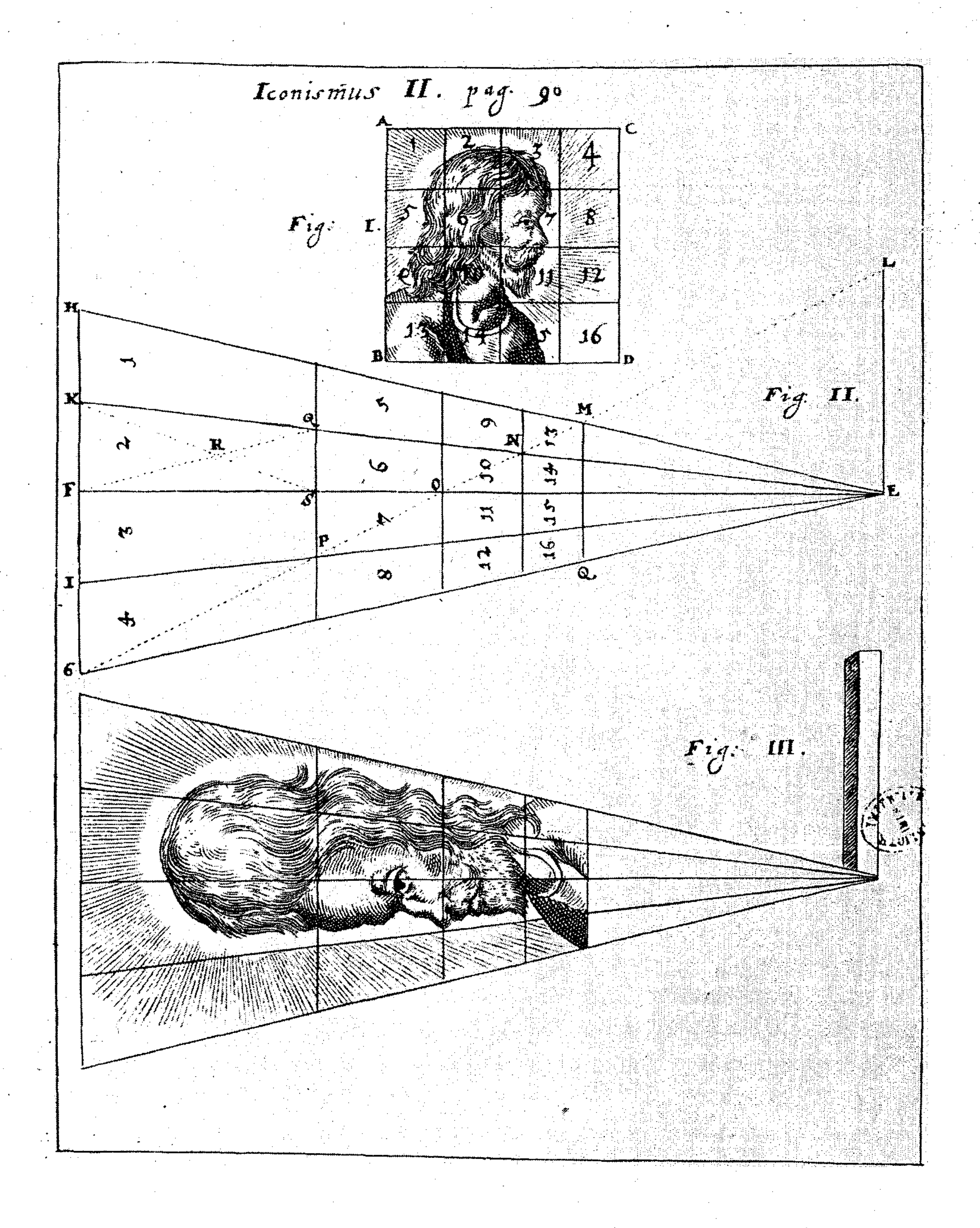


FIG. 61 Anamorphic diagram by Gaspar Schott, 1657

the origins of the Roman anthropomorphic hill but also the source of Kircher's description of Mount Athos. It was indeed taken from Vitruvius, from the preface to Book II. The disciple is much more precise and scrupulous than the master. His advice is also more logical and more practical. Medium-sized and small compositions should, for preference, be projected with a string that can be adjusted on the 'sight' of a mesoptic frame on the principle of Dürer's 'window', which is in fact the better instrument. We have almost returned to Nuremberg, and it is natural that the German scholar, so meticulous in all his references, should have found the prototype of all these devices created by his illustrious compatriot.

The 'window' is carefully described, first as an instrument for precise perspective:

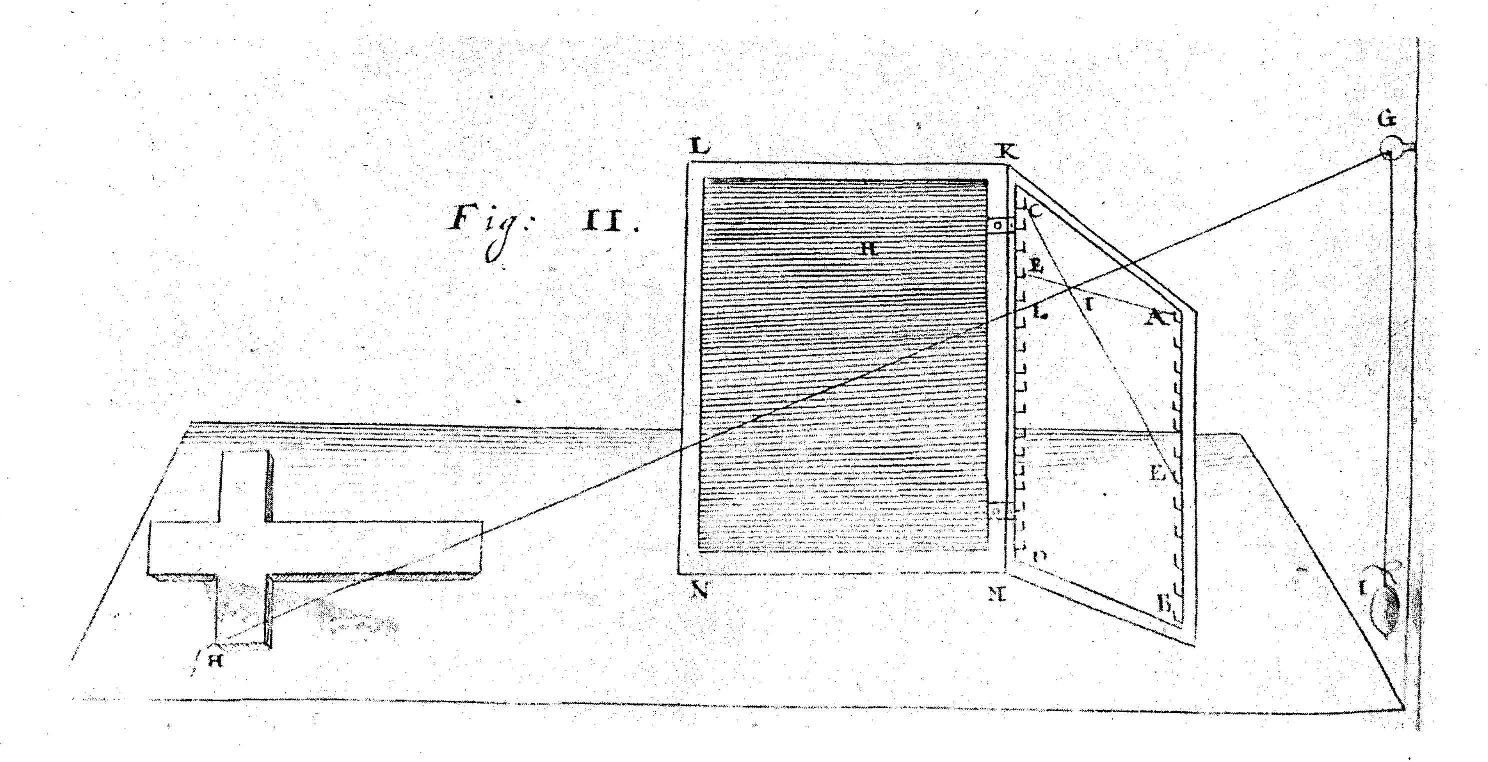


FIG. 62 Dürer's 'window', after Gaspar Schott, 1657

De fabrica et usu portulae opticae Alberti Dureri, then as a distorting tool: *De portulae Dureri usi in deformatione imagum* (fig. 62). The drawing in Schott's treatise is inspired not by Dürer's original engraving, reproduced by Barbaro in 1559, but by the replica of Vignola-Egnatio Danti (1583) in which the frame is not fixed but simply placed on the table (fig. 63).[24] Vignola-Danti's *Le due regole della prospettiva pratica* (*The two rules of practical perspective*) was reissued in Rome in 1648 while Schott was staying there on his way back to his native land, and there is no doubt that it was from this book that he borrowed the drawing.

With the exception of small hooks fixed on the uprights to hold the two diagonal strings, the structure of the frame and of the shutter and the arrangement of the strings are identical, but the way in which they are used marks a complete break with prevailing tradition. It is no longer a matter of establishing normal perspective. From now on the 'window' also becomes a magical instrument which can be used for anamorphoses. It was enough to follow the example of Emmanuel Maignan whose fresco Schott had seen and whose contrivance for the extension of images 'on very long walls and pavements' he recommended: that is to say, putting the subject not on the surface in front of the frame but on the shutter and projecting it with the aid of an optical string on the place normally reserved for the objects. Maignan's *Perspectiva horaria*, published in 1648, two years after Kircher's *Ars Magna*, provided all the technical instructions for such projections.

The 'gibbet' procedure that the Minims set up was finally restored to its model. No doubt in proposing the inverted use of the 'window' they were convinced that they were revolutionizing its function. When Niceron stated that Cigoli's universal instrument fulfilled all that he claimed concerning oblique perspective, he was

anxious to add the words 'that its inventor had not perhaps envisaged'. This certainly applies to all the other early apparatus. However, in 1559, when Barbaro revealed certain 'secrets' of perspective for the first time, he implied, as we have seen, that optical distortions can also be obtained by mechanical devices: 'One can produce the same result [elongated figures] without sun, lantern and perforated paper, first with the rules set out in the second part [geometrical gradation], then by means of instruments which we shall be describing in the final part of the book.' He is in fact alluding to the 'window' which he reproduced in the manner described in Dürer's treatise. It would be surprising if the inventor of this tool, which played such an integral part in his studies on vision, had not himself envisaged its use in reverse, about which its interpreters boast (fig. 64).

Thus, Albrecht Dürer's 'window' was imitated, its imitations were modified in successive examples (Vignola–Danti, Wenzel Jamnitzer, Johann Heiden) its basic elements were restored by Salomon de Caus (1612) and Accolti (1625), and it was brought back in its original form and its various functions in the mid-seventeenth century thanks to the French Cartesians in Rome.[25]

A whole series of forms and techniques, re-made and re-thought elsewhere, were retransmitted to a centre which had contributed considerably to their early dissemination. Gaspar Schott's work is undoubtedly only a miscellany and the presentation of the question in its final state, but it constitutes a link with an ancient world. More obsessive and insistent, the supernatural character of these illusions goes back to their original conceptions. Furthermore, the regrouping and accumulation of these strange ideas in a coherent entity echoes the encyclopaedic

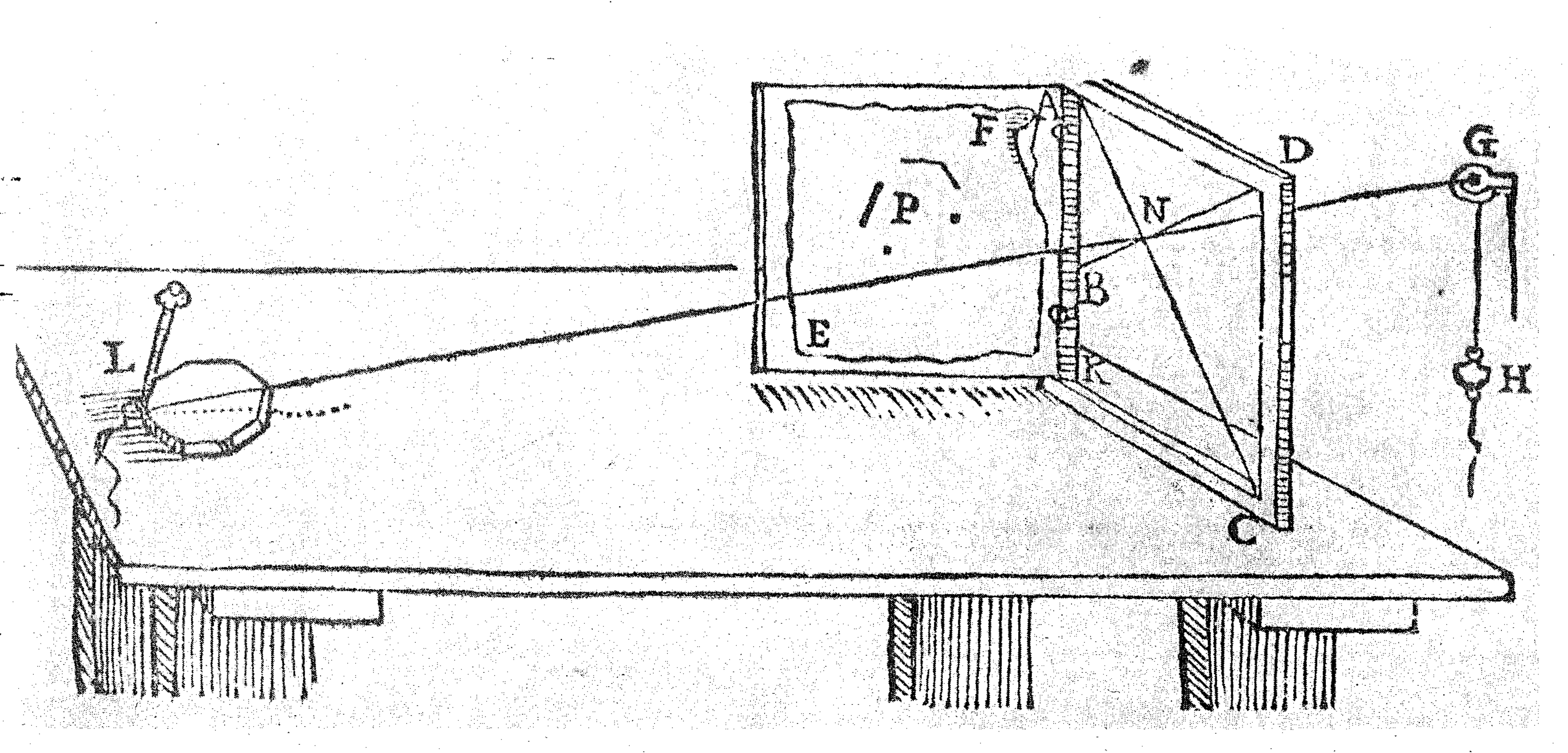
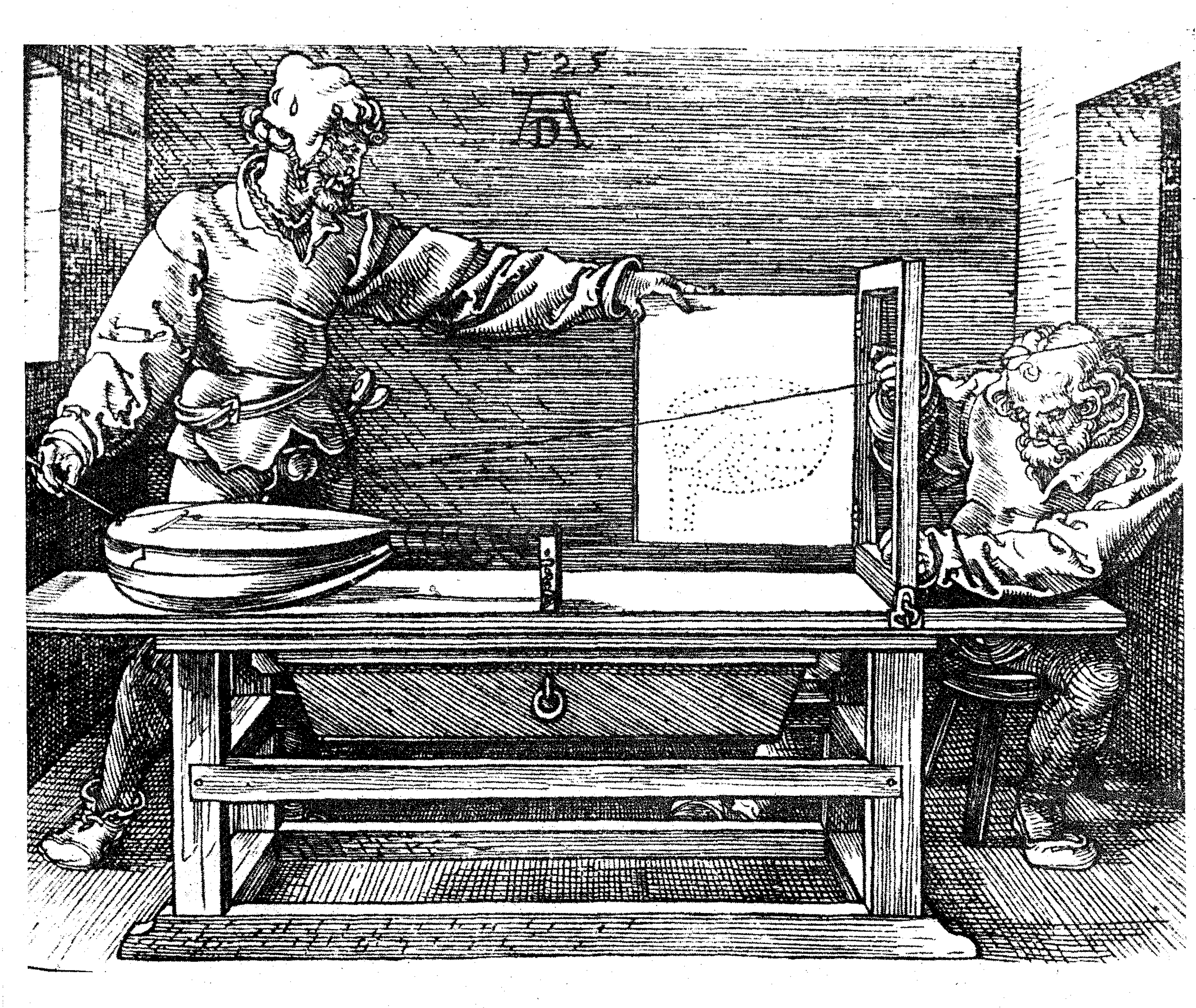


FIG. 63 Dürer's 'window', after Egnatio Vignola-Danti, 1583

tradition of the Middle Ages and the Renaissance. Optical eccentricities were revived in all those branches of the Arts and Sciences – arithmetic, geometry, physics – with which perspective was always associated, and were transposed into the realm of fantasy. Schott's *Magia universalis* was based on Kircher's *Ars Magna.* It corresponds to an era in the history of thought when popularized scientific doctrines spread simultaneously with legend. The whole universe became a *Wunderkammer* and the book on it a *Wunderbuch.*[26]

And it was only after this long journey, with their means and methods newly defined and reintegrated in a speculative world, that certain directions of primitive anamorphoses were clarified. It is only in the light of all these related developments that Holbein's great masterpiece *The Ambassadors* assumes its full significance.

FIG. 64 Dürer's 'window', 1525



CHAPTER SEVEN
Holbein's 'The Ambassadors'

Holbein's *The Ambassadors* dates from 1533, the year of one of Schön's engravings and of the anamorphic portrait of Charles V.[1] The picture was painted in England where the artist settled permanently in 1532. The two French ambassadors, Jean de Dinteville, Seigneur de Polisy (1504–65) and Georges de Selve, Bishop of Lavour (1509–42), are portrayed life-size in front of a table, or rather a range of shelves, the top of which is draped with an oriental tapestry. Behind them is a silk curtain. The floor is paved with a pattern of inlaid marble which is a reproduction of the mosaic in the chancel of Westminster Abbey, executed in the time of Henry III.[2] Dinteville's broad shoulders are further accentuated by a wide fur coat with puffed sleeves. Around his neck hangs the Order of St. Michael. The dagger that hangs at his side has his age, twenty-nine, inscribed on it. De Selve whose age, twenty-four, appears on a book placed near him, is wearing a deep purple gown. He holds a glove in his right hand. Their bearded faces are calm and inscrutable (fig. 65).

The objects arranged on the shelves are carefully chosen. On top we see a celestial globe, astronomical instruments, a book, a sundial; below, a terrestrial globe, a set-square, a pair of compasses, a lute, two books – *The Arithmetic of the Merchants* by Petrus Apianus (Ingolstadt, 1527), and beside the Bishop, who was a learned music-lover, sympathized with the Reformation and spoke fluent German, the *Gesängbüchlein* by Johann Walter, published in Wittenberg in 1524. The hymn-book is open at Martin Luther's Chorale.

In the top left-hand corner of the painting a silver crucifix is suspended from the wall, half-hidden by the curtain. A strange object, like a cuttle-fish bone, floats above the floor. It is an anamorphic distortion of a skull which is restored to normal when one stands very close, looking down on it from the right. On the floor behind this is a lute-case, face down and scarcely visible. A mysterious air of solemnity broods over the whole scene. The dignitaries – so worthy, so imbued with their mission and their knowledge – the earth, the sky, the apparatus for measuring the world, Christ, the enigmatic skull – everything is so realistic as to verge on the unreal. The numbers and letters, the globes, the texture of the clothes are almost deceptively life-like. Everything is astonishingly present and mysteriously true to life. The exactness of every contour, every reflection, every shadow extends beyond



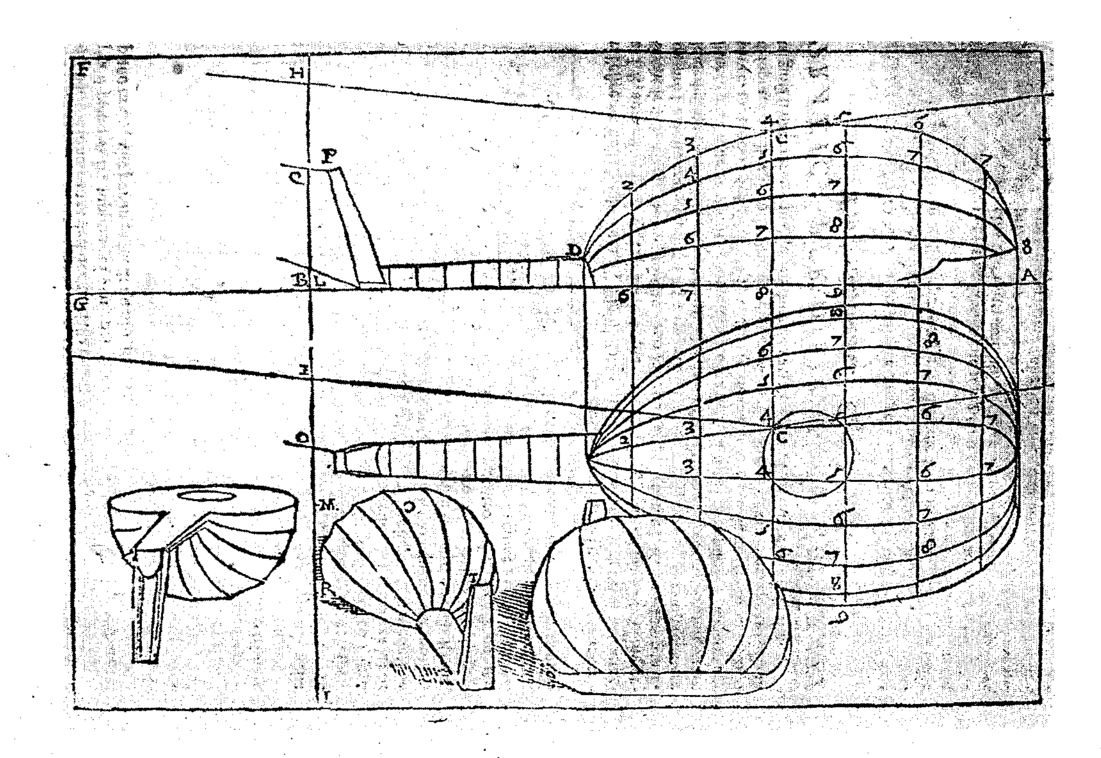
FIG. 65 Hans Holbein: *The Ambassadors*, 1533. National Gallery, London

the material it represents. The whole painting is conceived as a *trompe-l'oeil.*

All the objects have a symbolic value and relate to the quadrivium of the liberal arts: arithmetic, geometry, astronomy, music. But some of them are at the same time themes of perspective, often described in books. In Dürer the globe or sphere is represented as a regular body; the clock, very similar to Holbein's, is also present, and of course it is a lute that is placed before the 'window' in an almost identical foreshortening (fig. 64). In Barbaro (1559), in addition to these three objects, there are astronomical instruments directly following the description of the sphere with its optical projections and gradations. Astronomy – the perspective of the heavens – is closely associated with perspective in the strict sense of the word. The celestial globe occurs among the items in Jean Cousin's frontispiece (1560). The figure personifying Perspective sometimes holds a globe and a cube, linked to the eye by visual rays.[3] In Salomon de Caus (1612) one chapter is entitled 'How to depict a lute, foreshortened' and, again, his drawings are similar to the lute in Holbein's picture. Accolti in 1625 also shows a lute in a whole series of foreshortenings (fig. 66).[4] The still-life mounted on shelves between the two ambassadors brings to mind a list of contents in an artists' manual, and the treatment of the skull is like a practical application of the anamorphic procedures often taught in such books. The painting is a systematic study and a demonstration of perspective in all its forms and at the same time an allegory of the Arts and Sciences, often allied in these books, but whose principal features go back to scientific theories of the universe, represented in Italy from the last quarter of the fifteenth century.

The marquetry executed about 1480 for the *studiolo* of Federigo da Montefeltro in his palace at Gubbio (the inlay is now in the Metropolitan Museum of Art in

FIG. 66 Perspective of a lute, P. Accolti, 1625



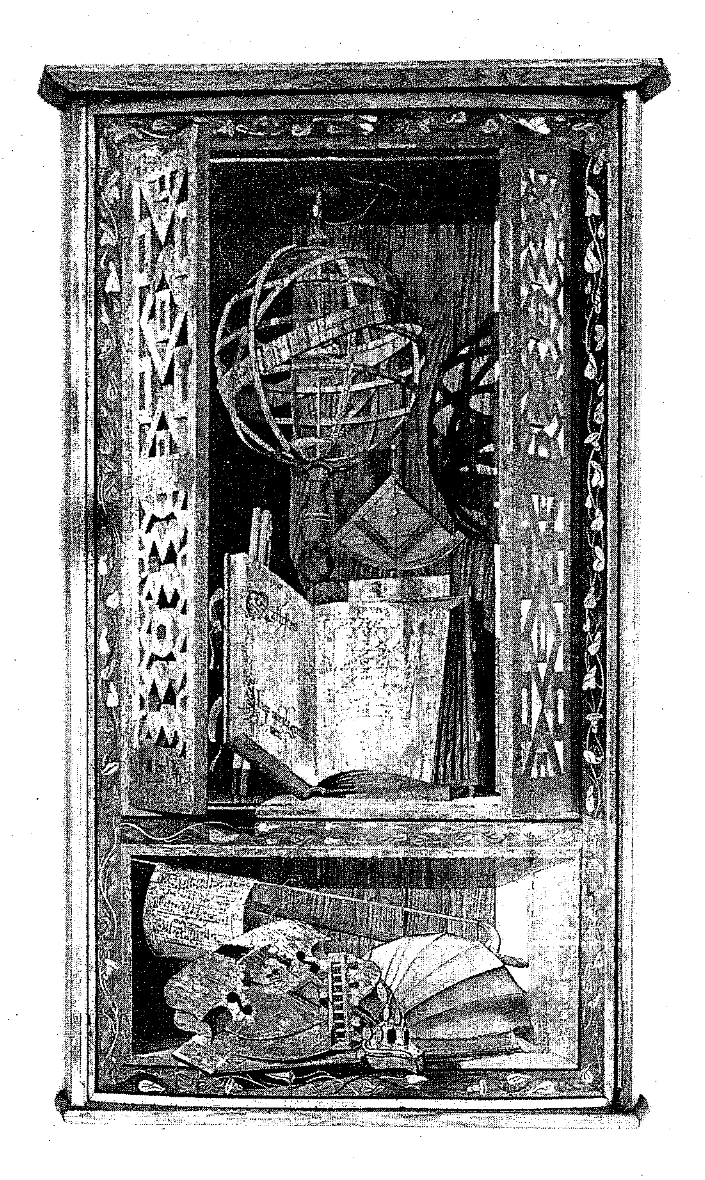
New York), brought together the same sorts of objects even at that early date: the lute and other musical instruments, the celestial globe, astronomical instruments, an hour-glass and compasses, books placed in half-open cupboards, as in a scholar's study. It is in fact one of the first and most complete depictions of scientific symbolism, and the choice and arrangement of the objects reveals an extraordinary subtlety. The inlay symbolizes the union of the Arts and Sciences, the relations between geometry – space – and music – time; between the music of the spheres and the harmony of sounds, in accordance with the theories of Pythagoras and Plato that Italian humanism had brought back into fashion.[5] All the Arts and Sciences flow out of the same concept of the world's harmony and complement each other. Their strength and universality stem from this union. This concept is illustrated not only by the juxtaposition of symbols but also by the art of their representation. A deep knowledge of all the rules of optics and projective geometry, the exactitude of the foreshortenings and visual gradations make the objects stand out in such relief that, at first sight, one wonders whether this can really be a two-dimensional work.

Joined to these allegories of science and art the action of perspective assumes an almost symbolic value. It is, furthermore, represented by an emblem, a *mazzocchio*, placed in a corner as though it is an afterthought. Emanuel Winternitz has compared it to that seen in Piero della Francesca's *De Prospectiva pingendi*, dedicated in 1469 to Federigo da Montefeltro, later Duke of Urbino, and there is no doubt that the whole ensemble is linked with the research carried out by a circle of artists and scholars who were of Piero's immediate entourage.

The whole atmosphere of the speculative universes which revolved around perspective systems in the course of their development is thus found associated with them from the start, and it is the same picture of vast syntheses which reappears in Hans Holbein. This time, however, it is no longer a glorification of human knowledge but a representation of Vanity.

It was Charles Sterling who established the principal stages in the development of the theme.[6] It made its first appearance in the Northern Schools and included only a very limited number of objects: a skull and a fractured brick (Rogier van der Weyden, reverse side of the Braque triptych c.1450, The Louvre); a skull with an inscription (Jan Mabuse, reverse side of the Carondelet diptych, 1517, The Louvre); a skull, a book, an extinguished candle (Barthel Bruyn the Elder, 1524, Kröller–Müller Museum, Otterlo, The Netherlands). It is a summary reminder of the transitory nature of life. The composition is generally placed inside a niche and the treatment is the *trompe-l'oeil* kind as in the scientific still-lifes. Sterling sees classical influences: a skull, with a wheel of fortune nearby, is to be found in a Pompeian mosaic, and he explains the choice of the device by the wish to intensify the impact of the physical presence of the *memento mori* by condensing its realism. Once again we discover an example of the convergence of forms and symbolism.

This still unambiguously medieval obsession with the triumph of Death now spread, incorporating the most diverse elements. Inevitably the Arts and Sciences were also to become the object of the theme. The idea was embodied in a philosophic doctrine belonging to the same current of thought, but its iconography was



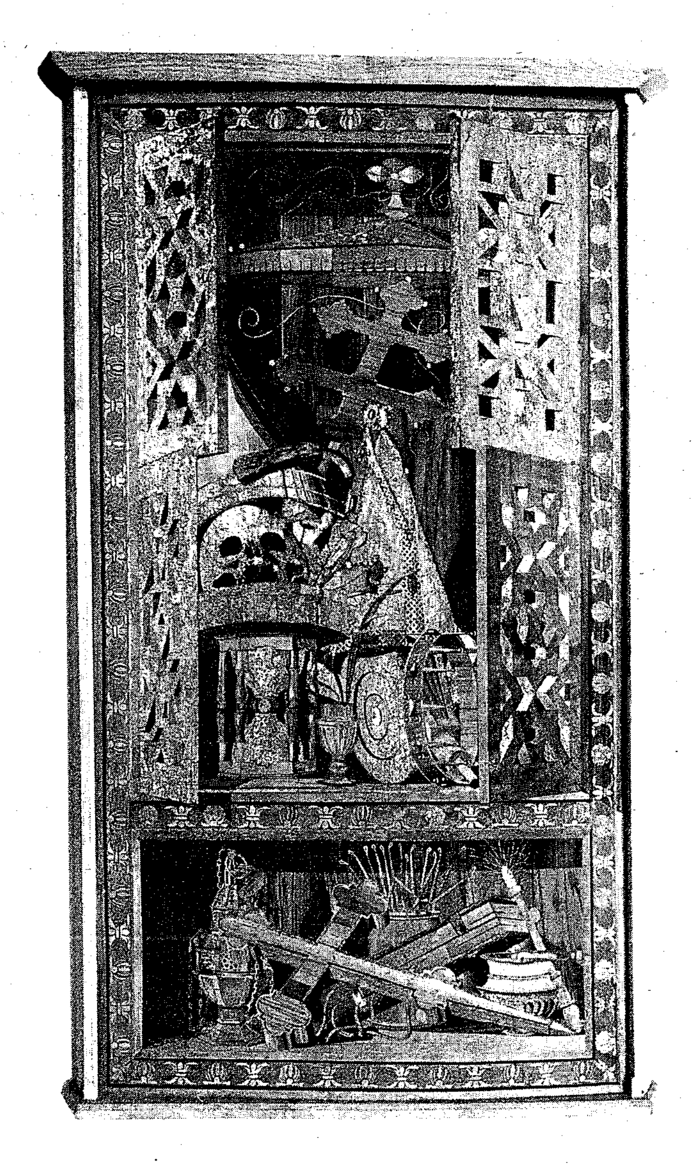


FIG. 67 Vincenzo dalle Vacche: Vanity of human knowledge and Vanity of earthly, ecclesiastical and lay powers. Marquetry, 1520–23. Louvre, Paris

established in Italy which had already been producing representations of it in increasing numbers. The marquetry panels by Fra Vincenzo dalle Vacche, called Vincenzo of Verona, carried out about 1520–3 for San Benedetto Novello of Padua, conform exactly to the tradition of scientific still-lifes, inaugurated half a century previously, but they are transposed into a realm of negation (fig. 67). In them one finds the same astronomical and musical emblems – a celestial sphere and a sextant, an astrology book open at the geometrical diagram of a horoscope, a lute, a viol, a bow, and a sheet of music, all scattered on two shelves of an open cupboard. But this is no longer the apotheosis of Pythagorean constructions: the two candles are extinguished, an allusion to the brevity of the light they can give, a viol string is broken.[7] The second panel contains a Papal cross, a mitre, liturgical furniture, a book, accompanied by a skull, an hour-glass and a vessel containing a plant, symbolizing the flight of time, as in the Psalms (Ps. 103: 'As for man, his days are as grass') and in the Book of Job (chapter XIV: Man . . . cometh forth like a flower

Holbein's painting, with its display of scientific instruments, the haughty demeanour of the personages, the magical setting, shows a close kinship with these reflections. *The Praise of Folly* continues:

> Philosophers are worthy of respect with their beards and their gowns. . . . What pleasure it is for them when in a philosophic ecstasy they create a countless number of different worlds in the universe, when they give us the sizes of the sun and the moon, the stars and other globes with as much exactitude as if they had measured them with their ruler and line . . . when they pile triangles, circles, squares and an infinity of other mathematical figures one on top of the other, interlaced in labyrinthine forms . . . and throw shadows on things that are clearest . . . . They know absolutely nothing and they boast of knowing everything.[12]

And in fact we see these globes, figures, measuring tools, piled up next to the philosophers, bearded and sumptuously clad, who seem to be enclosed in an artificial domain and separated from the world.

The idea echoes Brant, but it also echoes a medieval reflection already formulated by Hugues de Saint-Victor. His treatise *De Vanitate Mundi*, composed in the first half of the twelfth century in the form of a dialogue between the soul and the reason, the *Interrogans* and the *Docens*, betrays the same scorn of scientific knowledge:

> D. – What do you see?
> I. – I see a meeting of students . . . children, adolescents, young men and old men. . . . I see some who are absorbed in calculations. Others strike a taut string with a piece of wood, producing melodies from it. Others . . . are explaining geometrical figures. Others, with the help of instruments, are plotting the course and position of the stars and the revolution of the heavens. . . .
> D. – This semblance of truth deceives you . . . these are studies not of wisdom but of human madness by which the imprudent and the foolish devote themselves uselessly and obstinately to researches into the nature of things.[13]

The whole quadrivium files past here, like a symbol of Vanity and Folly: *Vanitas est, et vanitas vanitatum.* The inventors of the Sciences and the Arts in Erasmus are descendants of Saint-Victor's students. One of them appears in a pen drawing in the 1515 Basle edition of *The Praise of Folly*. In it one recognizes the philosopher with his beard and gown as well as the astronomer – or rather the cosmographer – with a celestial sphere, a terrestrial globe, arithmetical tables, a lyre side by side with a pair of compasses (fig. 68), foreshadowing the two *Ambassadors*.[14] The drawing has been attributed to Ambrosius Holbein, Hans's brother, which in no way lessens its historical interest.[15] When he multiplied the symbols, in 1533, Hans must have thought of this allegory of vain occupations which had impressed him in his youth. He had long been familiar with the concept and it took shape in the medium that expressed it most forcibly.[16] Before its realization, the theme had become entrenched in his mind. But, at the very moment when the double portrait was being executed, another book appeared which raised the same question.



FIG. 68 Ambrosius or Hans Holbein: *The Astronomer*, marginal pen drawing in *The Praise of Folly* by Erasmus. Basle, 1515

The Declamation on the Uncertainty, vanity and abuses of the Sciences and the Arts

by Cornelius Agrippa – the very title could apply to the painting – is a new development of the same theme.[17] 'Instead of magnifying the Sciences, my intention is, for the most part, to blame and despise them', writes the magician in his preface 'for there is nothing more perilous than to arrive at madness through reason and the accumulation of knowledge is not happiness'.[18] This passage reminds one of the change which had occurred between the presentation of the symbols of the sciences in the *studiolo* of Federigo da Montefeltro and in the compositions of Fra Vincenzo dalle Vacche and Hans Holbein. Instead of being honoured, the Arts and Sciences are presented under the symbol of Death. The anxieties of a tormented mind of the North confronted with Italian Humanism are similarly manifested, and the elements of the demonstration are repeated in the same order. Arithmetic, geometry, astronomy, music, all the Pythagorean concepts of their relationships are examined in turn, in 103 chapters. Agrippa's treatise is not a violent attack, rather it is an impassioned dissertation, interposed with diatribes against the nobility and the clergy, the bishops and theologians and reflecting a concern with the opposition between heavenly power and human knowledge and power.

'Arithmetic is no less superstitious than it is vain' and geometry is but an artifice. On the question of the heavens, 'the twelve signs [of the Zodiac] and other depictions and figures in the Northern and Southern hemispheres have no place other than in legend . . . and it is madness to divert oneself by measuring the earth, for in measuring it we go beyond measure.' It is also said that science is included in music and that there exists 'a certain music and harmony of the spheres which, however, no one has ever heard'. Folly and Vanity are synonymous. All is dust and illusion. Divine power alone knows and dominates everything. But 'the chamber of truth is shrouded in many mysteries and closed even to saints and sages.' The word of God is the only key to it.

Agrippa's book was written in Lyons in 1526 and first appeared in Antwerp in 1530. There were several subsequent editions published in Paris and Cologne. From 1511 to 1518 Agrippa was in Italy where he stayed in Milan, Pavia, Casale Monferrato, Pisa and Verona.[19] It is not beyond the bounds of possibility that he met Holbein in Italy. Furthermore, he was interested in painting and in optics and dealt with both in his treatise. He interprets perspective as an artificial system and includes it in the hierarchy of general knowledge. It is through wide speculation on universal values that we arrive at its specific forms, analysed from the same point of view. He defines its relations with other branches of science in clear terms: optics, also called perspective, directly follows geometry, and (after painting, and engraving) is succeeded by cosmography: thus perspective is one of the geometrical measures of the world. But it is also a hoax. Two important definitions are formulated after this statement: 'Perspective teaches us the reasons for false appearances as they offer themselves to the eye,' whereas painting, which borrows from optics, 'by means of false measurements causes things to appear other than they in reality are'. The book already contains the germs of a Cartesian discourse and, furthermore, the comments on perspective could, without changing a word, be applied to true anamorphosis which is merely a paradoxical extension of the same rule.

The observations on painting are no less revealing. It is the classic *trompe-l'oeil*

> such as is found described in stories of the wager between Zeuxis and Parrhasius when Zeuxis brought grapes painted with such care and labour that birds were deceived into thinking they were real and natural grapes and flew up to eat them whereas Parrhasius set up a picture on which a curtain only was painted, which deceived his rival, for it was so well counterfeited that Zeuxis thought it was only the veil and that the picture was underneath, so that he began to say proudly that he had deceived the birds: 'Uncover your picture and show us what you have painted.'

If one artist deceived the birds, the other deceived a master. The story is borrowed from ancient sources but it applies to a manner of painting which was now widespread, and specifically in those very still-lifes and subjects with which we are concerned. Charles Sterling has drawn our attention to their relationship to Graeco-Roman methods and themes, basing his research on textual references rather than on the works of art themselves.

Horace Walpole has a similar anecdote about Hans Holbein.[20] Before leaving Basle for England in 1526 and wishing to leave proof of his skill, the artist painted a fly on a portrait he had just completed. The purchaser of the portrait, trying to remove the insect with a brush, discovered the jest. The story spread, and arrangements were set in motion to retain this virtuoso in the country. The painter therefore had to leave the town in great secrecy. Whether the story is true or apocryphal (the fly was a favourite *trompe-l'oeil* subject of still-life painters), it fits in with similar research concerning form.[21] These legends, however, assume their full significance in Agrippa's treatise on Vanity in the Arts and Sciences. The conception of painting and the conception of perspective, as they emerge from Agrippa, confirm the convergence of themes and techniques in allegorical pictures of the deceptive appearances in the world and, at the same time, put all the problems of deceptive vision on the same philosophic plane. Anamorphosis and *trompe-l'oeil* belong to a similar order of things: false measurement and faked reality. By juxtaposing both these techniques in the same picture, Holbein certainly showed an awareness of the affinity between the two.

Let us however return to the precise significance of his painting. In its treatment of the Vanities which all more or less convey the kind of anxiety which haunted Cornelius Agrippa, though in a more guarded and serene language, the painting corresponds very closely to the *Declamation*. The conclusion of the treatise's final chapters can be read like a commentary or accompaniment as we face Holbein's great picture:

> What we think to be science is only error and falseness.... Arithmeticians and Geometricians number and measure everything, but the soul still remains unnumbered and unmeasured. Musicians treat of sounds and songs, but fail to hear the dissonances which are in their minds. Astrologers seek the stars and discourse on the heavens, and presume to foretell what will happen to other people in the world, but pay no attention to what is near them and is present every day. Cosmographers have knowledge of the land and the sea, they teach us about the boundaries and limits of every country but they do not render Man

> either better or wiser. . . . He who has learnt everything and has learnt only these things has learnt all that he has learnt in vain. For the word of God is the way, the rule, and the target at which, whoever does not wish to err should aim, and thus attain to the truth. All other knowledge is at the mercy of time and oblivion and will perish: for all the sciences and arts will vanish away and others will replace them. . . . Divine Knowledge alone has no end and embraces everything. It is Jesus Christ, the Word and the Son of God the Father and divine Wisdom, the true preceptor who makes Man as he is in order to make us children of God as He is, who is blessed in all centuries.[22]

It is precisely this contrast of human vanities and the truth of God which is shown in Holbein's composition. In it are present not only the symbols of science but also a crucifix. The sciences that will perish are displayed in the foreground in front of a large, thick curtain. In medieval art the curtain was usually open, disclosing a revelation or a sacred vision.[23] In this case it is drawn on divine knowledge: 'the chamber of truth is closed even to saints and sages.' We guess at it in the background. The inlaid marble paving of Westminster Abbey, so surprising in the picture, leads to the chancel, and furthermore Christ half appears in the upper corner like a ray in His own dazzling kingdom.[24] He represents the goal. The artist has set Him, like a message, in the most distant corner, separating Him resolutely from vain knowledge and contrasting Him with the skull. Death and Resurrection are opposed on the same axis, drawn obliquely, with the skull which floats in the lower part of the picture as base. The solution is ingenious since it allows the defining of a complex reasoning without confusing the premises.

Could Holbein have seen the books I have referred to? By the time he left the Continent in 1532 to settle in England, Agrippa's treatise had already appeared in numerous editions and stirred up a violent argument. Erasmus himself wrote to Agrippa in a letter dated 19 September 1531, from Freiburg, where he had taken refuge in 1527: 'All the talk is about you, concerning the new work which you have written about the uncertainty and vanity of the sciences, of the vanities of the disciplines. I do not know it yet but I am setting about obtaining a copy.'[25] Now, it was at this very time that Holbein was painting a second group of portraits of the aged Erasmus, and there is no doubt that the two met each other again.[26] If he did not know the book already, Erasmus must have mentioned it to him.

It is therefore a theme and a symbolical still-life which took shape in Italy, completed and developed by an idea linked to Northern influences, which is found in Holbein's work. But the figures are arranged in accordance with an independent scheme which in its turn is based on related but much older material, introduced in the Middle Ages with the *Dit des trois vifs*, next finding an outlet in the *Danses macabres* and constantly associated with the Vanities and with allegories about the fickleness of the world.* Holbein, deeply affected by the sudden loss of his parents and his brother Ambrosius, often returned to these visions of men and skeletons.[27]

**Dit des trois vifs*, a reference to the popular legend – *Dict des trois morts et des trois vifs* (full title) – linked with the French *Danses macabres* and the German *Totentanz* (Dance of the Dead). The word 'Dit', here means 'tale' or 'legend' 'of the three Living' who joined in a dance with three 'Dead'. For full bibliography of this subject see J. Baltrušaitis, *The Fantastic Middle Ages* (Cambridge, 1977), chapter 7, note 16. *Translator's note.*

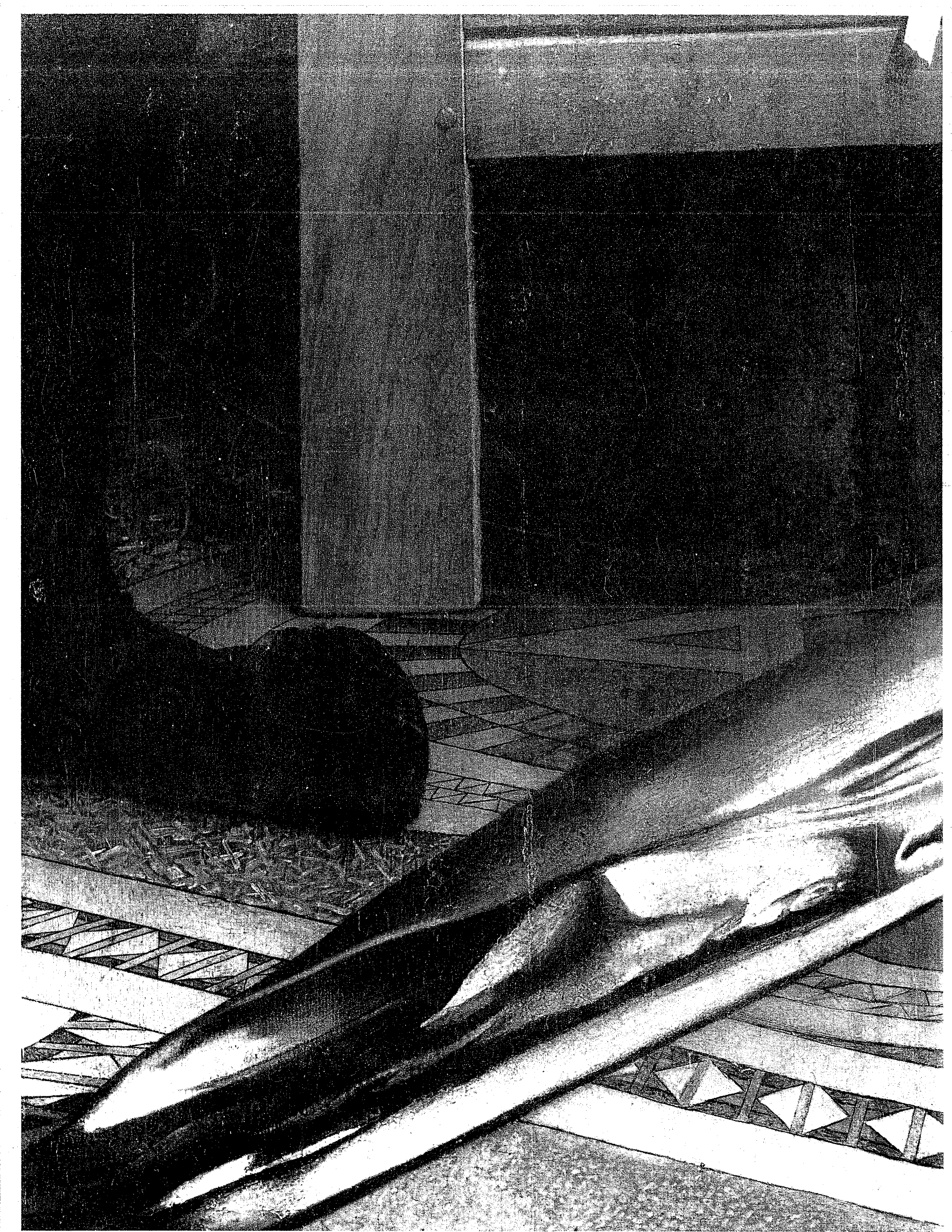
A drawing that accompanied his *Totentanz*, executed in Basle in 1526 and not published until 1538 (in Lyons), was directly inspired by Dürer's *Wappen des Todes* of 1503.[28] It shows a sumptuously dressed couple, divided by a shield displaying a skull. The coat-of-arms is surmounted by a helmet with an hour-glass as a crest (fig. 69). These heraldic forms were to reappear and assume new dimensions in *The Ambassadors*. The main features of the later work are identical: an individual on each side, the clock above as a reminder of the flight of time, the skull below.

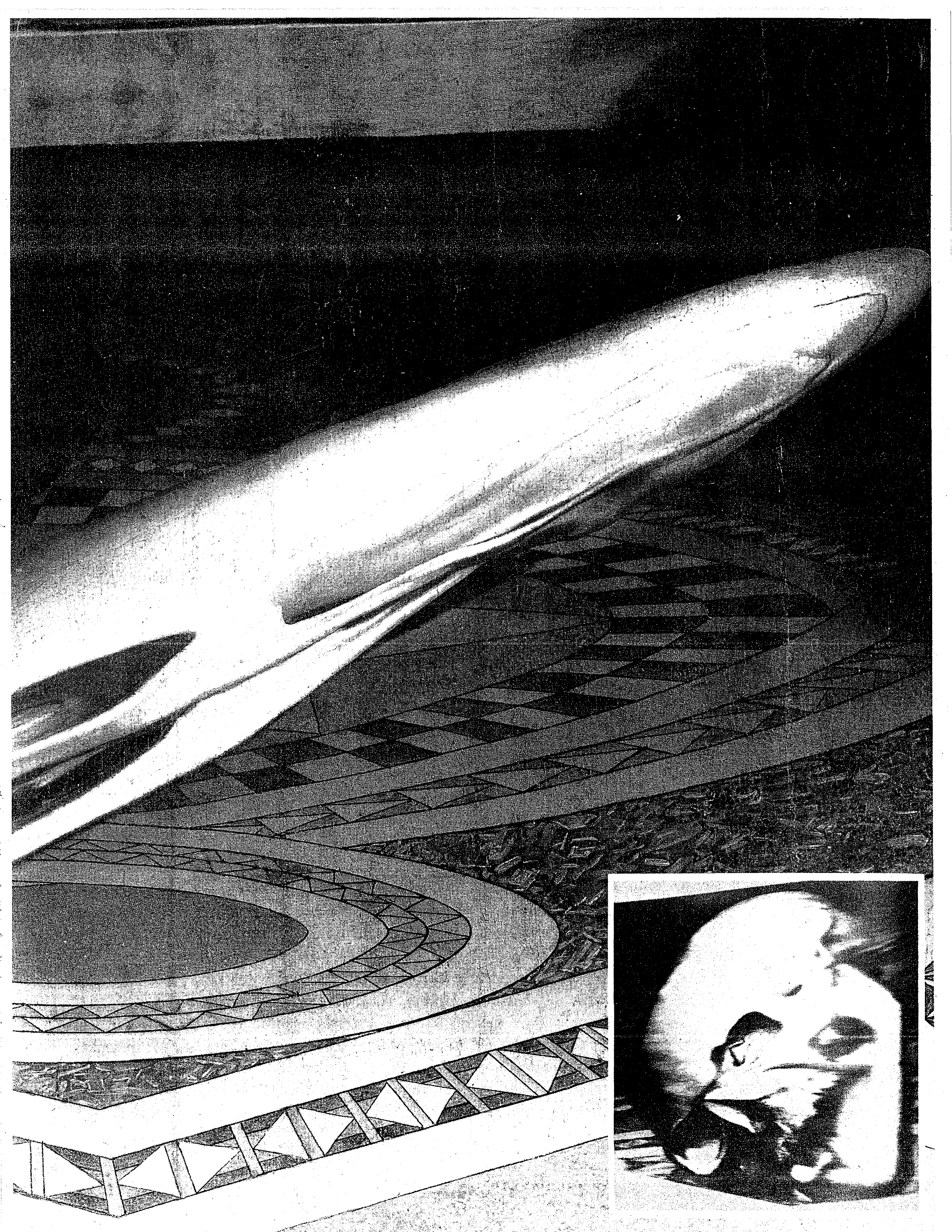


FIG. 69 Hans Holbein: *The Coat-of-Arms of Death*, 1525

OVERLEAF

FIG. 70 Holbein's *The Ambassadors* (detail): the anamorphic skull and its optical correction





The two ambassadors stand upright like the supporters of the coat-of-arms of Death, with instead of a shield a display of the Vanities. If we see the painting in terms of a coat-of-arms, it acquires a hieratic nobility which enriches its symbolism. It shows an impassive nobility of bearing. But the representation of the skull belongs to another tradition (fig. 70). It is in some way isolated by the anamorphic treatment. It is as if there were not one but two compositions, each with its own viewing-point, but juxtaposed in the same frame. Even the shadows do not go in the same directions. The principle is analogous to that of a triptych or diptych of religious images or portraits with a skull on the back of the panels.[29] If P. Ganz's attribution is correct, Holbein himself about 1517 had painted two skulls on the exterior of a Basle diptych showing two boys.[30] The symbol of Death appears when the panels are closed – in the picture of the two ambassadors it materializes when the spectator moves. Barbaro's remark that 'many times with no less pleasure than amazement one looks at some of these perspective-pictures, when, if the eye regarding them is not at the fixed viewing-point, they appear totally different' alludes to optical substitutions. But in an ensemble so skilfully conceived there is no question of using Barbaro's projection device with perforated card, or Vignola's oversimplified formula.

The geometrical procedure based on the visual angle, a developed form of which is revealed in a sketch of 1540 by the Nuremberg Master H. R., or again one of the mechanical tools which proliferated after the example of Dürer's 'window' (1525) would be more in keeping with the arrangement and spirit of *The Ambassadors*. The presence among the symbolic objects of, on the one hand, a set-square and a pair of compasses, and on the other hand, of scientific apparatus, seems to indicate the use of one of these technical devices. The anamorphosis takes place in a painting which, with its dimensions and its arrangement, is intended for a particular position in a vast room, like the optics, the anoptics and catoptrics in Niceron. The whole programme, the development and extension of which I have traced, is already there, with its elements organically united. In arranging the sequence of two independent images, Holbein has not disassociated them. He conceived his *Vexierbild* in terms of a theatre, with a change of scene and décor as in a dramatic spectacle.

The painting was to be hung following precise instructions: in order that the effect of its composition should be as intended, it had to be placed at the base of a wall, on a level with or slightly above the floor, which would seem to extend into the picture. In the Château de Polisy, the reconstruction of which was begun in 1544, Dinteville no doubt had it placed in a vast room, opposite one door and near another, each corresponding to one of the two viewing-points. Let us imagine a room with an entrance in the middle of one side, and two side-entrances opposite, with the picture placed between the two side-doors, in the axis.[31]

The Mystery of the Two Ambassadors is in two Acts. *Act One* is played when the spectator enters by the main door and finds himself a certain distance away from the two nobles, who appear at the back as on a stage. He is amazed by their stance, the display of luxury, the intense realism of the picture. He notes a single disturbing factor: the strange object at the ambassadors' feet. Our visitor advances in order to

have a closer look. The scene becomes even more realistic as he approaches, but the strange object becomes increasingly enigmatic. Disconcerted, he withdraws by the right-hand door, the only one open, and this is *Act Two*.[32] As he enters the next room, he turns his head to throw a final glance at the picture, and everything becomes clear: the visual contraction causes the rest of the scene to disappear completely and the hidden figure to be revealed. Instead of human splendour, he sees a skull. The personages and all their scientific paraphernalia vanish, and in their place rises the symbol of the End. The play is over.

Part of a vast iconographic cycle, this optical setting, predestined in a way for the representation of the theme, was certainly exploited by other artists. It occurs much later, arranged in accordance with a variety of devices. When Niceron reports in his *Curious Perspective* that 'one can make certain drawings which, according to where they are viewed from, represent two or three quite different things', he is alluding to a similar subject: 'seen from the front, they will represent a human face, and seen from the right, a death's head', and he goes on to say that 'these drawings have become so common and trivial that they are seen everywhere.'[33] The method described by him is different: 'Nothing more subtle is involved in making them than to cut two drawings of the same size into small strips lengthwise and to arrange them on the same background, which can be a third drawing of the same size', but he also refers to the sequence of these same spectacles showing life and its annihilation by the change of position device.

The anamorphic skull figures in other artists' manuals. One finds it mentioned in Lucas Brunn's treatise, published in Leipzig in 1615, which could also have been found at a Nuremberg bookseller's.[34] This work contains a perspective layout of printing type as a pendant to Johann Lochner's *Perspectiva literaria* (1567), mentioned in the preface in connection with an automatic apparatus. The skull represented in one of the drawings has been elongated with the help of such an instrument (fig. 71).[35] The commentary describes it as an oblong stone (*ablanged stein*) or a little stick (*stoclein*). Apart from the expansion in width, the skull anamorphosis that floats at the feet of Holbein's two ambassadors is appreciably similar in appearance and directs our thoughts to the same objects.

With Fr. Du Breuil (1649), we have a catoptric anamorphosis, constructed round a cylindrical mirror which conceals the sinister image of a skull (fig. 72).[36] Placed on a cabinet or a table, this would suddenly appear, like a *memento mori*, to those who looked at themselves in the convex mirror. The drama, represented in the painting, is transposed into life itself and is played out with visitors to the house. Here again, the evocation of the spectre of Death is produced by optical devices. The same obsession is regularly incorporated in the same forms.

The elements can be reversed. In a contemporary English painting preserved in the castle of Gripsholm in Sweden, the skull is reproduced in a normal way and it is the man's image that expands in a series of circles (fig. 73).[37] This composition is a catoptric version of the anamorphosis of Charles I (fig. 20). The skull is placed horizontally in the centre of the picture. The king, beheaded in 1649, rises above it when one places the cylindrical mirror over it. He vanishes when this is removed and the features of the skull are revealed.

FIG. 71 Lucas Brunn: Anamorphosis of a skull, 1615



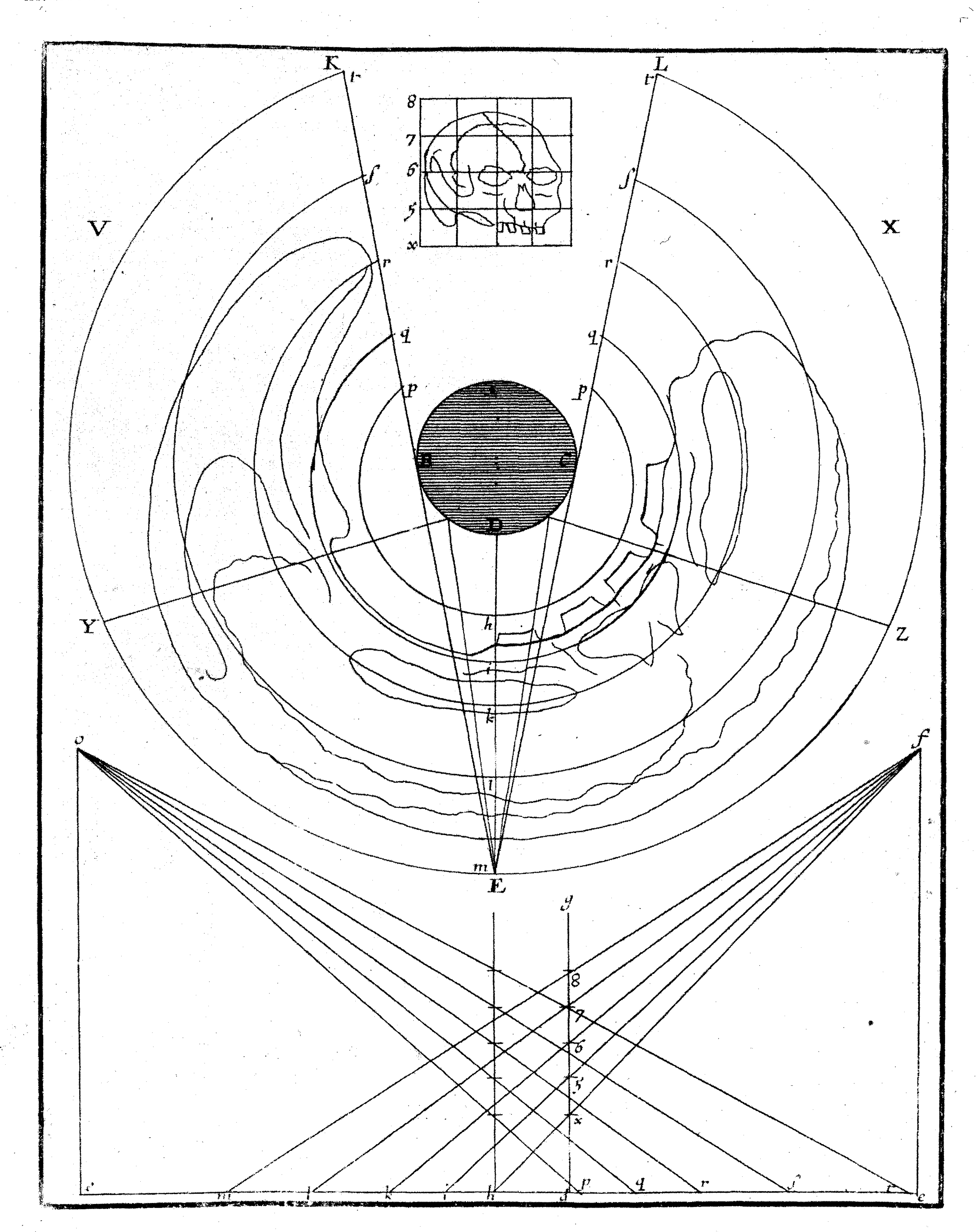

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FIG. 72 Fr. Du Breuil: Catoptric anamorphosis of a skull, 1649

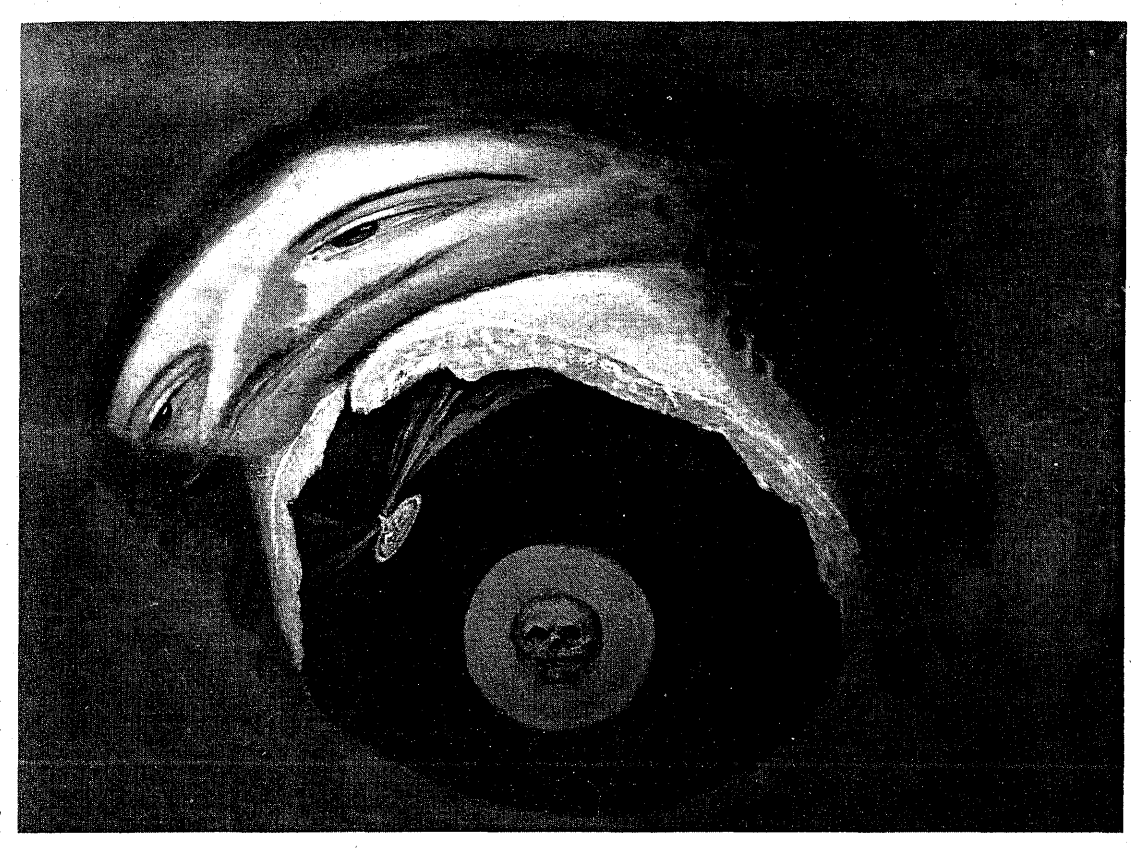
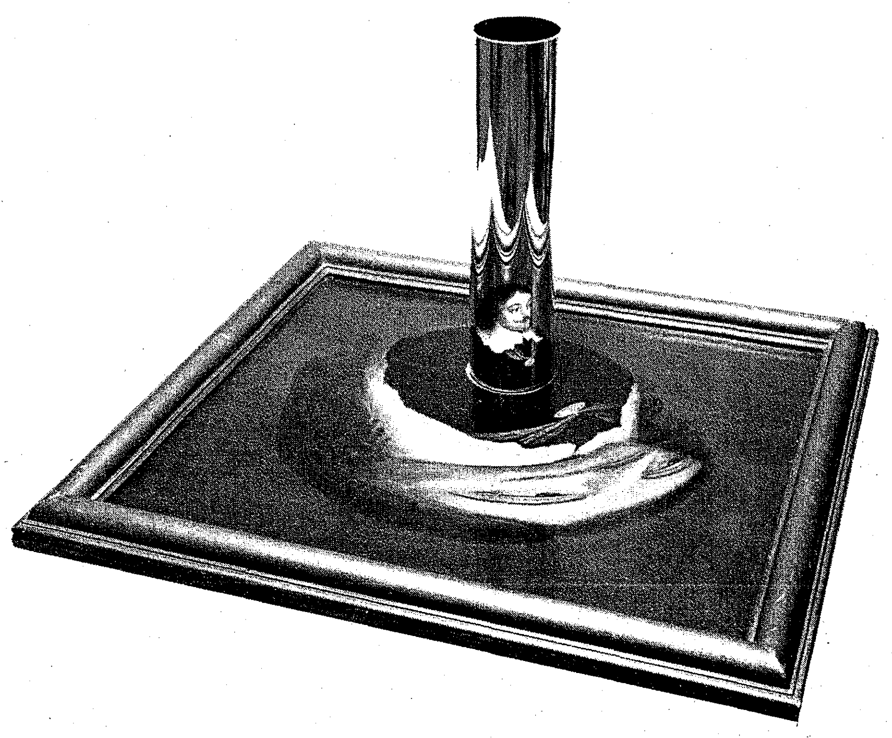


FIG. 73 Anamorphic mirror portrait composed around a skull: Charles I: post 1649. Gripsholm Castle, Sweden



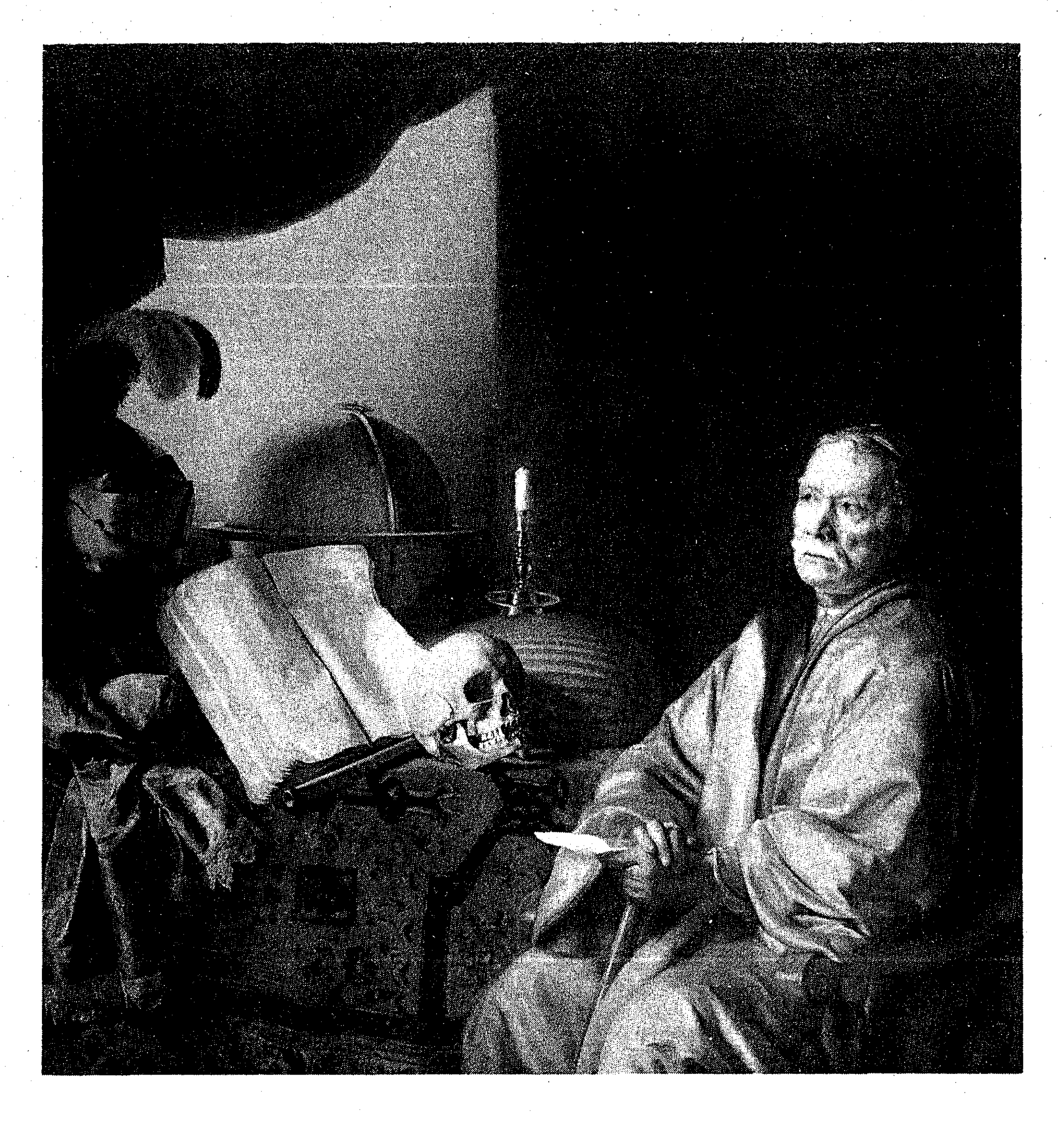


FIG. 74 Ferdinand Bol: *The Meditating Philosopher*, c. 1670. Louvre, Paris

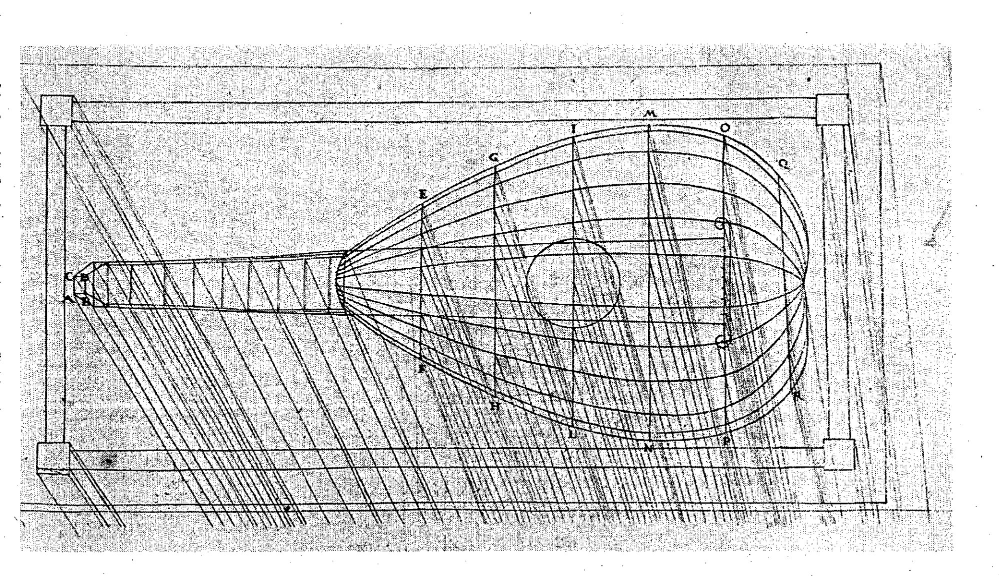
The Vanities in the accepted sense were enjoying a new vogue at this period. After a scarcity of examples during the second half of the sixteenth century, one sees them spreading throughout the whole of Europe north of the Alps. The University of Leyden became an important centre of Calvinist asceticism and, furthermore, specialized in studies of inscriptions and emblems. David Bailly, the Steenwijck brothers and other Leyden painters excelled in these melancholy visions.[38] In France the theme was particularly common in the reign of Louis XIII. Still-lifes express the insubstantiality of matter – faded flowers, bruised fruit, gnawed cheese, stale bread – and time's winged chariot – watches, hour-glasses, candles – in a vocabulary often more familiar, but none the less charged with symbolism.[39] Musical instruments, scientific apparatus, *mappae mundi*, globes, books with engravings of death's-heads, are reminders of the relationship between the Arts and the Sciences, the spheres and the harmony of sounds, all accompanied by a disillusioned commentary.[40] The awakening of Humanism takes place in the mid-seventeenth century, but stamped with the seal of the macabre Middle Ages. On a picture by Ferdinand Bol (c.1670) our philosopher reappears, sunk in meditation beside a symbolic still-life (globe, lute, book, extinguished candle, etc.) (fig. 74). Behind is a curtain. A skull grins in the foreground. The theme of Holbein's *Ambassadors* has become more explicit and is stripped of its mystery.

Death is not hidden and the curtain does not conceal the 'chamber of truth': it has risen to reveal light.

The game of allegories with an exaggerated realism now reaches its climax. The fleeting and the inconstant are always suggested by extraordinarily immediate and unchanging objects, the destruction of matter and ideas by the wholly material power of their evocation. The mechanics of optical illusion, perspective and *trompe-l'oeil* contribute by their very nature to the condensation of the poetic subject.

The totality of thought closely linking philosophical conceptions, technical visual devices and symbolism is revived on the same plan with further ramifications. The globe and the lute which one finds in the perspective treatise by Salomon de Caus in 1612, arranged in the same foreshortenings as in Dürer, Barbaro or in the marquetry discussed earlier, also have a symbolic role (fig. 75). De Caus, who was also interested in sundials (astronomical perspective), himself expounds, in his *Harmonic Institution* (1615), the theories of Pythagoras and Plato in which music is recognized as the universal science of the world and as the harmony of the spheres.[41]

Conversely, artists' forms and allegories remain constantly linked to the speculation of the philosophers and scholars. Kepler (1596), who repeated all the Renaissance ideas on music and the harmony of the spheres, makes use of the five regular Platonic bodies of the *Divina Proportione* to calculate the orbits of the planets.[42] Robert Fludd (1617) depicts the one-stringed instrument on which the cosmic symphony is played, not unlike the lutes in the pictures of Vanities.[43] And it is the same object which in Fr. Mersenne's *Universal Harmony* (1636) represents the Great



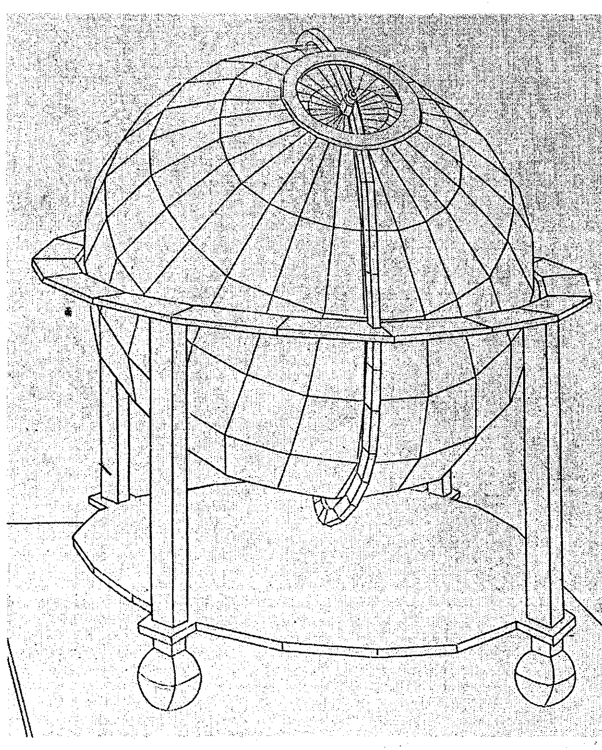


FIG. 75 Salomon de Caus: *The Celestial globe* and the *Lute*, 1612

FIG. 76 *The Great Lyre of the Universe*, Marin Mersenne, 1636, after Robert Fludd, 1617

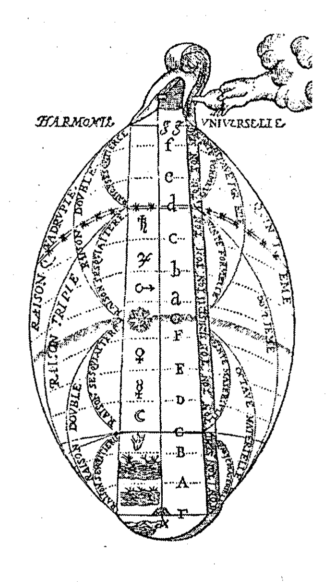


FIG. 77 *The Academy of Arts and Sciences:* painting on canvas. Bernard Monnier Collection, Paris

Lyre of the Universe in which phases of the world are arranged with their elements in octaves, chords and scales (fig. 76).[44]

This drawing provides the key to a whole group of these representations in painting. The empty lute-case placed flat in the shadow of the lower shelf behind the skull at the feet of Holbein's *Ambassadors*, signifies the stilling of all the science and harmony represented by the instrument. All the sciences can be taught through music 'with the use of no other language than that of the lute'. There is an arithmetical division of harmony and a geometry of sounds, not to mention the harmony of the stars. Mersenne's book, with its initially limited subject, ends by uniting all the branches of the quadrivium represented by the same musical symbol in innumerable still-lifes, but it also expresses a fear:

> now, it is only too easy to learn humility from all the sciences, for, leaving out Physics, about which the best minds admit frankly they understand almost nothing, we do not appear to know how we understand and reason in Logic. . . . If we consider the purest Mathematics, we are forced to admit that we know little about the subject. [And, he concludes] We have reason to humble ourselves in our ignorance which we cannot remedy until it pleases God to deliver us from the faith we put in the stupidity of the senses.

This could almost be a quotation from Agrippa, whose work was reprinted in French many times between 1600 and 1630, and it could likewise be considered as

a commentary on the Vanities which were spreading at precisely that period.

Mersenne's book, the work of a Minim of a Cartesian monastery, assumes a particular importance, since it allows us to see how the realization of the vanities and follies of human sciences leads directly to philosophic doubt. In the process, by describing their nature, it forms a link with the experiments on deception in the realm of pure optics which were being assiduously carried out in the same centre and which illustrated the same theme.

The same perspective systems, musical instruments, astronomical spheres, are brought together again in a picture painted at the very end of the seventeenth century. The doctrines of Pythagoras and Plato concerning the unity of the Arts and Sciences, which, after the Gubbio marquetry and Holbein's *The Ambassadors*, so profoundly affected the theme of scientific still-lifes, were reaffirmed in 1698 in a famous print, *The Academy of Arts and Sciences*, by Sébastien Leclerc.[45] In effecting the union of the two independent French Academies, Mazarin's founded in 1648 and Colbert's in 1666, the very title of the engraving followed these doctrines. A copy of the engraving exists, painted on a large canvas (0·95 m. × 0·48 m.); in which the many details are more exact and recognizable – it was probably executed, therefore, in direct cooperation with Leclerc (figs. 77 and 78).[46]

In it we see a large and busy crowd in a vast courtyard bordered with galleries and porticoes. In the foreground, a magician in oriental costume, like a 'necromancer', is reading the lines of a youth's hand. Marine plants, skeletons of a man



FIG. 78 *The Academy of Arts and Sciences:* engraving by Sébastian Leclerc, 1698. Prouté Collection, Paris

and a stag, a tortoise-shell, a heron, are assembled under the columns on the left, constituting a collection of the natural sciences. The flight of steps on the right leads to a library bearing the inscription *THEOLOGIA*.[47] Geometrical figures are drawn on the paving, on a colonnade and on the parchments. We can also identify plans of the Louvre and of fortifications, a display of apparatus and a collection of coats-of-arms. A seated man holds a 'table of sines'. People are grouped around, and innumerable instruments are scattered on the ground, including an Archimedean screw, a burning-glass, a magic lantern and a clock. The movements of the people are skilfully arranged and coordinated.

The symbolic lute and globe, always associated with these pictures, appear on two levels. Three spheres, one of them partially draped, are shown in front of the steps of the portico of the zoological museum. Musical instruments, including the lute, are silhouetted before the gallery in the background, bathed in light. An orchestra is playing. The music which accompanies the 'ballet' of the academicians comes from a distance, like the music of the spheres. A twelve-sided figure, the fourth of the regular figures often shown in these ensembles, is also visible, set among a heap of astronomical instruments. There is also an octagonal stone like the 'octagonal body' which is foreshortened in the treatise by de Caus.[48] We move along to perspective proper. It is demonstrated among the displays by four representations, all aligned along the 'proscenium'. On the left is Dürer's 'window', then, in the centre, two modern dioptric and catoptric inventions. The dioptric apparatus combines several images which, seen through a multi-faceted glass, unite in another different image. The process was provided by Niceron who learned about it in Lyons in 1635 when he was on his way to Italy, where, as has already been mentioned, he painted Turks' heads which change into a portrait of Ferdinand II, Grand Duke of Tuscany, which is now in the Science museum in Florence.[49] A cylindrical mirror placed on a circular anamorphosis represents catoptric devices, which spread widely during the same period. The same instruments are similarly juxtaposed in an engraving by de Molinet, in his book on the collection of the Bibliothèque Ste Geneviève published in 1692.[50] The fourth demonstration of perspective, on the right, is a direct anamorphosis. Jombert noted it: 'a flat surface on which is drawn a cylindrical figure which a man looks at with his eye at the viewing-point'.[51] In fact, this 'cylindrical figure' is an elongated skull, in every way resembling the one in Holbein's *The Ambassadors*. The skull is shown from the front and extends not vertically as in Brunn's *Perspective* but horizontally, with one of the eye-sockets bigger than the other; a long row of teeth forms an indented base, and even the angle of inclination is identical (fig. 79). The resemblances are so surprising that they make one wonder whether Sébastien Leclerc was familiar with the sixteenth century masterpiece.

It is known that, after the sale of Polisy in 1653, Holbein's painting was brought by the Marquis de Cessac to his Paris residence in the rue du Four near Saint-Sulpice parish church. The picture had acquired a considerable reputation. M. de Vic, Keeper of the Seals, said that it was 'the finest painting in France'.[52] A writer in 1654 refers to it in similar terms: 'the excellent picture which is at present in Paris in the house of M. de Cessac . . . the work of a Dutchman; the painting is

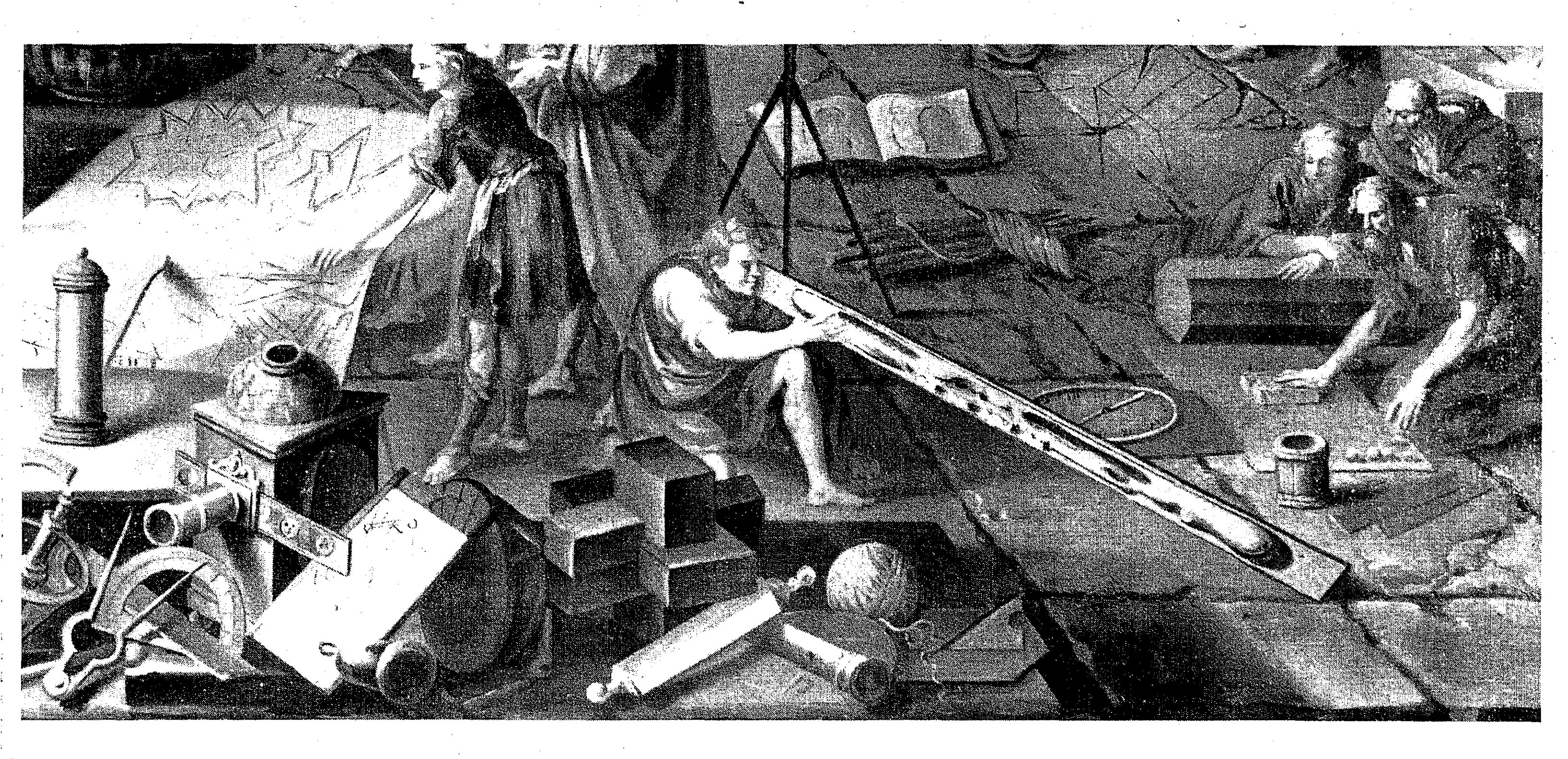


FIG. 79 *The Academy of Arts and Sciences* (detail): the anamorphosis of a skull. Bernard Monnier Collection, Paris

considered to be the most opulent and best worked in France'. When Leclerc arrived from Metz in 1665, the picture was still there.[53] Eager to know and learn everything possible, the young artist, a protégé of Le Brun, must have seen it.[54] The question arises as to whether Leclerc did not select certain elements directly from it for his academic 'apotheosis' which belongs in a similarly erudite world.

The comprehensive nature of Leclerc's subject is in keeping with the universality of the man, who by temperament and the demands of his profession was involved in every branch of knowledge. At Metz Leclerc worked as an engineer. He gave drawing and mathematics lessons to the son of Colbert, the future Minister of the Royal buildings. Admitted to the Academy of Fine Arts in 1672, he was made responsible for the teaching of geometry and perspective, and he collaborated assiduously as an illustrator with the Academy of Sciences.[55] In the field of cosmography we owe to him the illustrations for Picart's *Measurement of the Earth* (1671), and in architecture those for Perrault's *Vitruvius* (1673). His frontispiece for the *Natural History of Animals* (1671) included two globes and a skeleton. Leclerc collected instruments and machines of every sort – for mathematics, physics, astronomy and so on. His study, of which we have an unfinished engraving (1711) and a drawing, is crowded with these devices.[56]

These are the elements accumulated over the years, grouped around the time-honoured emblems of the quadrivium of the liberal arts but with an additional host of new objects. The men we see occupied with them and arguing together in *The Academy of Arts and Sciences* remind us of the philosophers of *The School of Athens* but they are more intense and impassioned in their enthusiasm. They have the fixed stares of men obsessed, utterly absorbed in their work and in their thoughts, astounded at the miracles of art and science that are assembled around

them. The theme of Vanity becomes somewhat blurred but its presence is still evident. The anamorphosis of the skull, and the skeleton hoisted up on the opposite side of the picture, pointing a derisive finger at its forehead, are specific symbols of the theme. The noisy workshop and laboratory mark the final stage in the development of silent still-lifes; but they retain definite memories of them.

Two phenomena emerge from a survey of this long evolutionary process: strict continuity and continual enrichment. All the systems of perspective have been elaborated, but independently of each other. It is a universal doctrine of vision, but it is surrounded by legend and speculative thought which continually renew its principles. Even in the rational forms, which represent life in depth and in relief on a two-dimensional surface, meditation on the falseness and insubstantiality of appearances is present. All the anamorphic devices which cause figures to rise up and disappear by means of optical arrangements and elongations are a geometrical proof of their insubstantiality. Sometimes we are shown a mere *jeu d'esprit* but even this borders on magic and conjuring. Secret portraits and obscene images are produced in the first half of the sixteenth century with the aid of clever calculations. These find their way into religious and symbolic compositions, mingling with scientific theories of the universe and with *trompe-l'oeil*. In several groups, the refinements of perspective were for long linked with a philosophy of artifice.

It was on the plane of pure science that anamorphoses were subsequently disseminated, but they evolved on the borderline between reason and madness. A veritable renaissance of forms and techniques occurred in the seventeenth century, bringing a wealth of books and explanations which threw a new light on the original concepts. Even academic circles paid them considerable attention. There was also an expansion into new domains. Elongated figures were suggested for the décor of houses. Strange optical effects were produced by conical and pyramidal perspective. Anamorphosis could be executed in marquetry and in rococo decorative work. In some cases the technique was used in works which extended along the full length of a gallery. Methods were taught for projecting its forms onto the landscape. Gardens, towns and even mountains were to be animated by its effects. Aberration had reached its climax.

However, all these developments took place against a background of inquiry about reality and the world of appearances. The men who concerned themselves with these laws of vision were mathematicians, engineers, astronomers, musicians and philosophers. They were all bound up with the universal humanist tradition, uniting the Arts and the Sciences, sometimes looking for the logical side to them, sometimes for the romantic. Interpreted by cool methodical minds, constructors of automata and logicians, the paradoxes of distorting perspective link up with the lofty ideas of the time. When taken up by fanciful dreamers and poets, its processes – in which everything depends on precision – recovered their vein of fantasy. By a strange irony of fate it was the Cartesians who, by deciphering with their clear-sighted reasoning all the secrets of these distortions and defining the phenomenon in precise terms, inspired their most absurd development. Nevertheless, all of them came to some understanding of the vanity of their devices. The image of Holbein's *Ambassadors* presides over the tricks of illusion in all their manifold variations.

CHAPTER EIGHT
Optical diversions in the eighteenth and nineteenth centuries

Anamorphoses and all the practices of distorted perspective survived the extensive speculative thought surrounding them, but were now stripped of their philosophic and legendary character. They continued, above all, as a scientific curiosity. This attitude, which applied to the majority of these compositions, made itself felt before Niceron's time and finally come to predominate. Claude Mydorge 'the first mathematician in France', who was associated with Descartes and cut different kinds of lenses and mirrors for him, had considered anamorphic work in this light.[1] His book *Mathematical Recreations* (1630), based on a minor work with the same title, published at Bar-le-Duc in 1624 by the Jesuit Fr. Leurechon, describes the process as a 'figurative caprice'.[2] Problem XIX is formulated as follows:

> Change the appearance of a figure such as a head, an arm or a whole body so that everything is out of proportion: the ears may appear as long as those of Midas, the nose like that of a monkey and the mouth like a gateway for carriages, and yet, seen from a certain point, they will reassume the correct proportions.

The phenomenon is presented in its entertaining aspects. One might expect that the scholar would have followed this up with his geometrical solution. However, like Barbaro, he omitted it as being 'too difficult to comprehend', and he too recommends that to create these distortions one should use the mechanical method 'with a candle or the sun', the light from which passes through the perforations in the drawing.

Anamorphic works undoubtedly continued to be produced on the frontiers of worlds built up by the French Minims and by the German Jesuits, but they achieved their greatest popularity in the period that followed. After the great works on optics and the occult sciences, they are found again in the work of Charles Ozanam, another well-known mathematician, who mentions them, not in his *Treatise on Perspective* (1693), but in his book of 1694 entitled, like Mydorge's, *Mathematical Recreations*, insisting that this is the category in which they belong.[3] A drawing which represents the projection of elongated forms by a perforated piece of cardboard shows an eye opened wide, with the eyelid swollen like a bladder, an image at once monstrous and superhuman. The image is borrowed from Bettini's *Apiaria* (1642), which was likewise conceived as a miscellany of oddities –

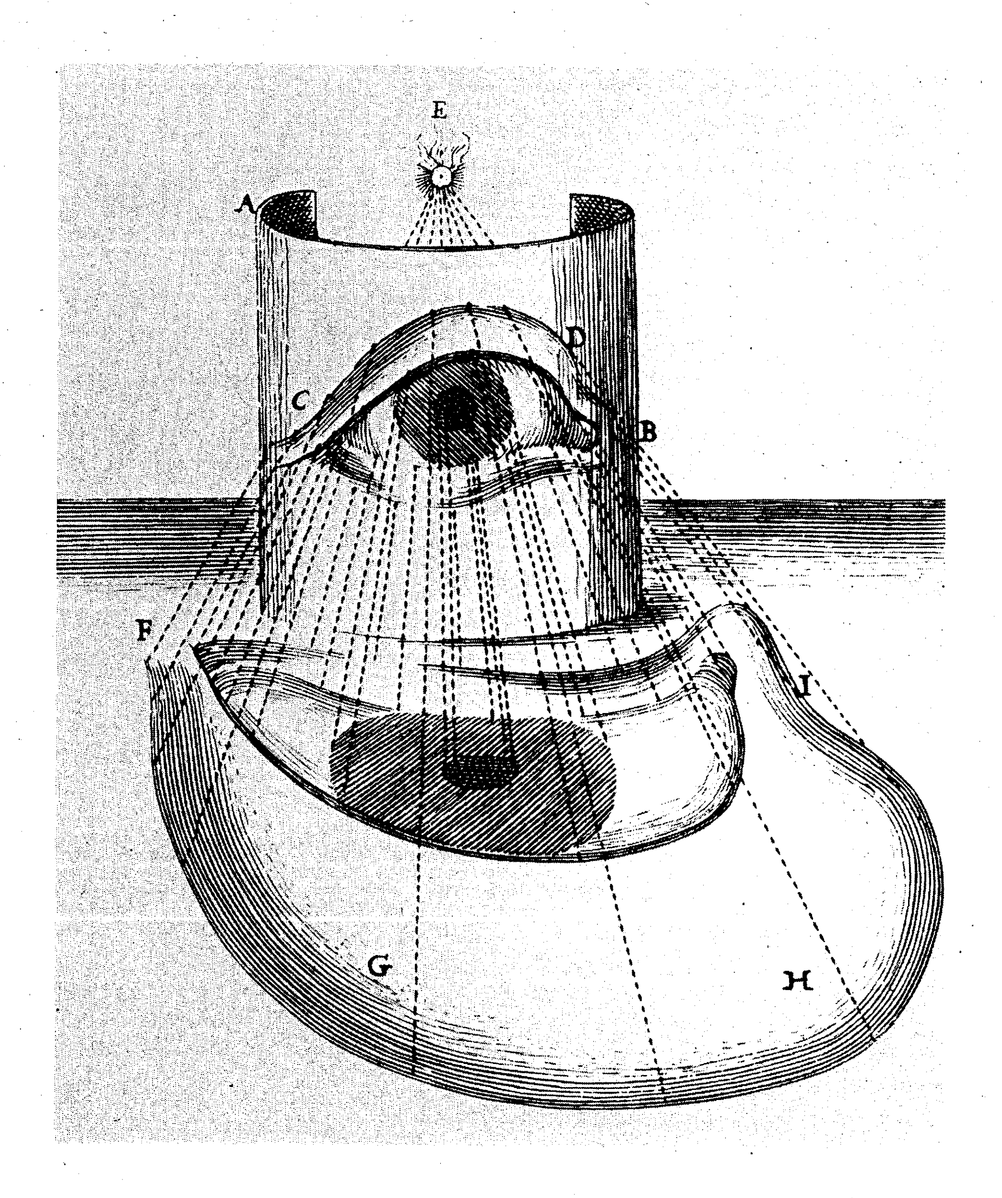
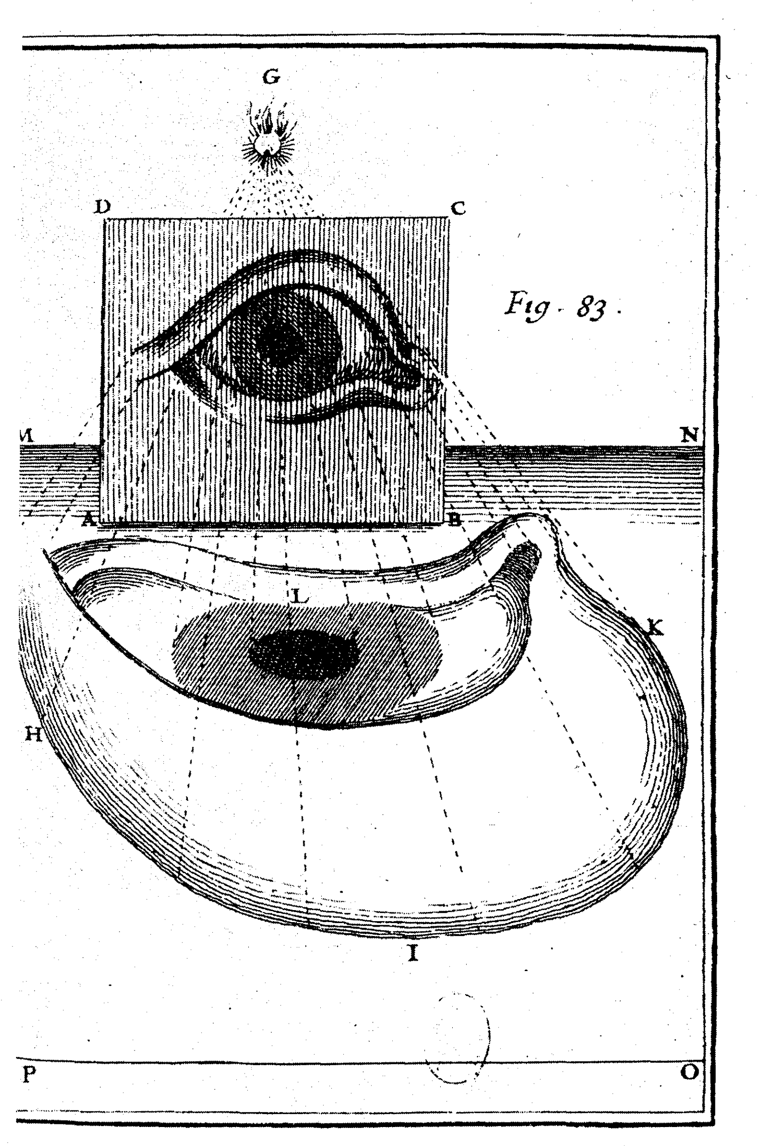
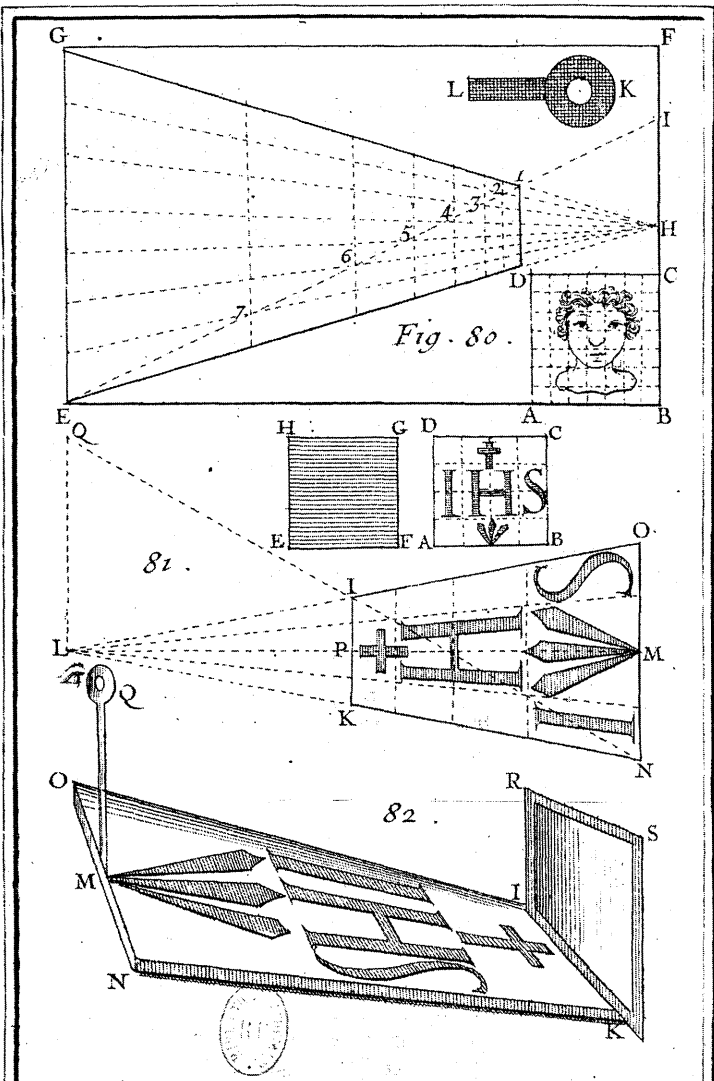


FIG. 80 Mario Bettini: the eye of Cardinal Colonna, anamorphosis in a cylindrical mirror, 1642

but still described as mysteries – in which we see anamorphosis with the cylindrical mirror (figs. 80 and 81).[4] The eye has a significance: it is that of Cardinal Colonna, Archbishop of Bologna, whose nomination to all his offices had been foretold by optical science. Colonna's eye, corrected in a mirror shaped like a column, symbolizes the great prelate's clear vision, whilst the restitution of the anamorphic figure corresponds to the 'correction' and salvation of souls that have strayed from the Bolognese church through sin. There is no hint of this approach in Ozanam. His commentary is dry and concise without the least digression. Projection by candlelight once again presents the most practical method. The distorted figure is restored to normality when the spectator looks at it through a peephole fixed at the viewing-point. It will also appear in its correct form on a glass if Alberti's 'intersector' or Dürer's 'window' method is used, methods also recommended by Bettini for direct anamorphoses.

If Mydorge's *Mathematical Recreations* of 1630 omit the geometrical process,





this was not possible in Ozanam's work of 1694, when so many manuals had been published examining it in full; so Ozanam provides the definitive formula, with a single diagonal line fixing the gradations of the grid recomposed on the visual rays (fig. 82).

This book which brings together the arithmetical, geometrical, optical, physical, chemical and mechanical paradoxes is a direct revival of the books of 'magic', such as Schott's, but restores them to the category of positive science. Monsters, marvels, astounding effects and supernatural phenomena become scholarly games, farces and technical tricks. They develop as an amusement of pure science, aiming to instruct by diverting. We have left the realms of fantasy far behind. Nevertheless, a kind of strangeness and a passion for curiosities survive. The book met with great success and went into several editions from 1725 to 1750.

The German scientific manuals of Sturm (1704 and 1714) and of Wolf (1715) introduced these optical games from the same technological angle.[5] The *Elementa*

FIG. 81 Charles Ozanam: anamorphic projection of an eye, 1694

FIG. 82 Charles Ozanam: anamorphic methods, 1694

Matheseos universae of Charles Wolf, professor of mathematics and philosophy at the University of Halle, was issued in an abridged French edition in 1747.[6] Perspective is divided into three parts – normal, military and 'curious' perspective. In the last part the word 'anamorphosis' – which still seemed a strange term – is explained by a definition from Niceron.

It was only with Diderot and d'Alembert's *Encyclopaedia* (1751) that the Greek neologism, current in German circles for a century, was finally accepted in France.[7] The article devoted to distorted perspective appears in the first volume under the letter 'A' and is entitled 'Anamorphosis', in accordance with the appropriated terminology. The word is explained: 'In painting, anamorphosis refers to the projection of an unnatural image or a distorted representation of an image which is made on a plane, and which, nevertheless, seen from a certain viewing-point, appears normal and executed with the correct proportions.' Technical instruction follows. The mechanical method proceeds 'by pin pricks' and by a demonstration of patterns by the light of a lamp. The pattern is elongated geometrically on a frame which is now, similarly, given a technical name: 'ectype' (from *ek*: 'out of' and *typos*: 'imprint'); 'craticular' (from *craticula*: 'small grid'.) The superimposition of a figurative depiction is also recommended: 'The spectacle will be much more agreeable if the distorted image does not represent pure chaos but rather some other scene; thus, we have seen a river with soldiers, etc., marching on one of the banks, represented with such skill that, seen from point "S", they appear to compose the face of a satyr.'

The article states that Niceron's frescoes (then still *in situ*) offer an excellent example of these interchangeable visions which never cease to surprise.

> In Paris, in the cloister of the Minims, Place Royale, one can see two anamorphoses, drawn on two sides of the cloister: one represents Mary Magdalene, the other St. John writing his gospel. They are such that when one looks directly at them, one merely sees a kind of landscape, but seen from a certain viewing-point, they represent very distinct human figures.

The vast compositions which inspired numerous developments are also discussed later.

Miraculous Optics – the *Thaumaturgus opticus* – is mentioned in the *Encyclopaedia* in connection with these frescoes, but the technical part of the article is based on Wolf's Latin text, not on Niceron's works. In it are the same definitions, the same formulae, the same nomenclature, including *craticula* and *ectypus*. The word *anamorphosis* (avoided in the French edition of Wolf's book, published less than four years previously) is obviously taken from the same source. After a long delay, French scholars adopted Schott's term, thanks to the persuasions of Wolf, the professor at Halle.

Now an inherent element of scientific manuals, anamorphosis also became a purely formal exercise of artists' virtuosity. But the old methods were continually being revived. Thus, in his *Treatise on Perspective* (1701), Bernard Lamy, a priest of the Oratory, repeats the 'catoptrics' of a head after Niceron (whose name he omits to mention), and an 'optical' mural with the projection of a grid by the

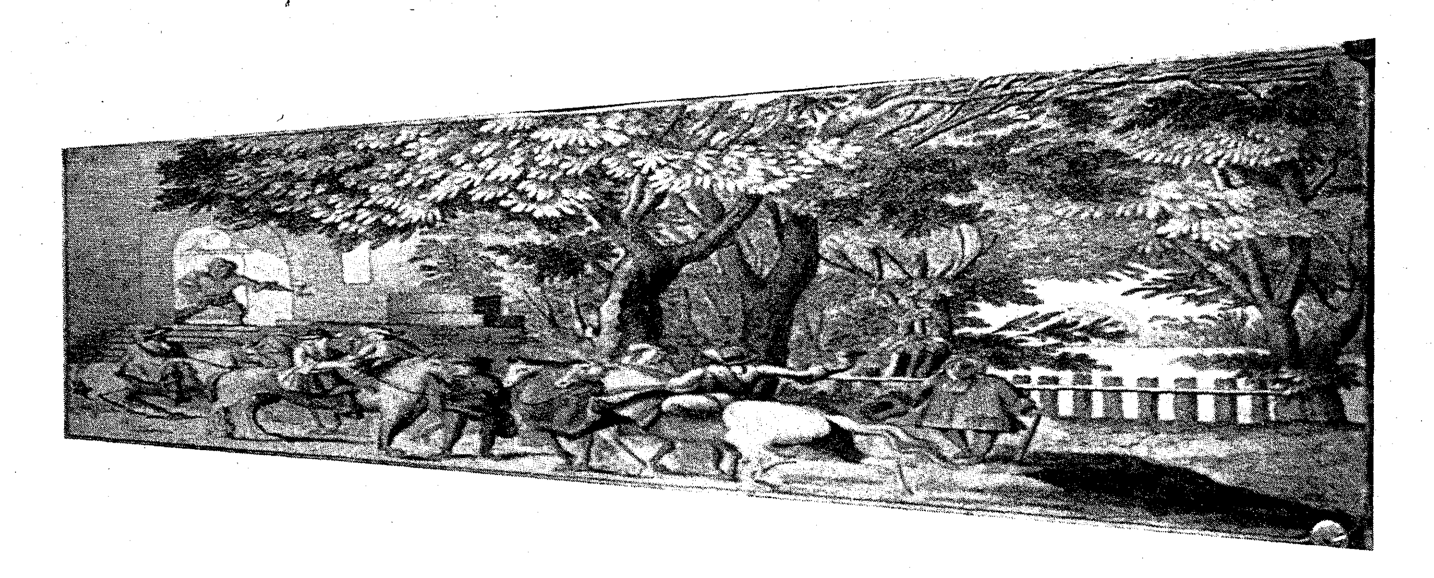


FIG. 83 Anamorphic composition: *Horsemen in the country*, 1720–60

candle method.[8] These are followed by a description of St. John the Apostle wearing a blue cloak and a green robe, which turn into sea and meadows, with a lake formed from the white pages of the open Gospel and a stream from the girdle. The landscape is described as being alive with ships, fishermen, animals and birds. Once again, Niceron's painting in the cloister at the Place Royale served as a model, but the replacement of a scarlet cloak by a blue one brings a seascape before our eyes. 'To make these representations more surprising, they are arranged to be seen through a hole in the entrance door, to which one applies a glass with a double lens.'

In Italy Niceron's geometrical system reappeared, together with Accolti's more complicated formula, in the treatise by Galli Bibiena (1732) who also makes references to Barbaro and Dürer.[9] But the anamorphic effects occupy relatively little space considering that the author was one of the boldest theoreticians of architectural and theatrical illusion. The fact is that play with mirrors (catoptric anamorphoses), introduced about a century before, was now everywhere on the increase, to the detriment of direct perspective.

The favourite subjects represented in anamorphic art during the eighteenth century were *scènes galantes*, hunts, horsemen astride short-legged horses (fig. 83), like the dogs in Marolois. St. George and the Dragon is the subject of an engraving by John Harris (1686–1739). As with the portrait of Charles I, the picture should be viewed from below, where one can read the caption: 'A George on Horseback drawn in Optiks; place the letter A close to your eye and look on it as you do when you fire a peece at a Mark.'[10]

Metaphysical reasoning concerning the laws of the vision of forms, their optical distortions and corrections, which Grégoire Huret considered as late as 1670 as questions of supreme importance, had descended into the realm of an amusing diversion.

But a very marked revival of old material soon manifested itself in a different connection. A strange work, published in 1804, suddenly brought back the most

extravagant schemes. J.-B. Lavit devoted an important part of Book II of his *Treatise on Perspective* to anamorphoses, the term which came naturally to him.[11] They were intended for the façades of buildings and for a variety of supports – side-walls, floors, domed and vaulted ceilings. 'Anamorphosis could serve', he states, 'to make a gallery appear to contain a larger number of statues than it contains in reality'. Niceron's conical and pyramidal perspective systems could multiply the illusions still more. Lavit also discusses perspective systems devised on several planes.

The subjects represented in this book derive from Antiquity – a helmeted head, an infant Hercules, dancing cherubs with garlands in their hands – but these images disintegrate with great rapidity. Extended on a visual triangle, a classical profile resembles that of a bird's head. Graceful childish forms expand or shrink as they turn in prisms (fig. 84). Graeco–Roman subjects break up on a subtle, cunningly extended framework. These are still mathematical exercises, but they demonstrate a nostalgia for the ancient world.

In one of his *Tales of Mystery and Imagination – Ligeia* – published in 1838, Edgar Allan Poe describes a vast scene of a similar nature, intensified by the strange and sinister objects and colours involved.[12] It is a bridal chamber, haunted by the narrator's dead first wife, Ligeia, in which his second wife, Rowena, the Lady of Tremaine, languishes and dies. The five-sided room was filled with exotic furniture, an Indian bridal couch and an Egyptian sarcophagus:

> But in the drapings of the apartment lay, alas! the chief phantasy of all. The lofty walls, gigantic in height – even unproportionably so – were hung from summit to foot, in vast folds, with a heavy and massive-looking tapestry . . . spotted all over, at irregular intervals, with arabesque figures, about a foot in diameter, and wrought upon the cloth in patterns of the most jetty black. But these figures partook of the true character of the arabesque only when regarded from a single point of view. By a contrivance now common, and indeed traceable to a very remote period of antiquity, they were made changeable in aspect. To one entering the room, they bore the appearance of simple monstrosities; but upon a farther advance, this appearance gradually departed; and step by step, as the visitor moved his station in the chamber, he saw himself surrounded by an endless succession of the ghastly forms which belong to the superstition of the Norman, or arise in the guilty slumbers of the monk.
>
> In the halls such as these – in a bridal chamber such as this – I passed, with the Lady of Tremaine, the unhallowed hours of the first month of our marriage.

The point from which these figures assume their correct form, fixed at the entrance of the room, as in the house of Bernard Lamy and in the galleries of the Minims in Paris and Rome, the dissolution of their features as one moves away – the whole anamorphic machinery is precisely defined in the description of this accursed dwelling. The 'antique' character of its fittings corresponds to popular anamorphic subjects of the early nineteenth century – with Midas, Hercules, cupids and satyrs – but the superstitions and the guilty reveries are an inheritance from the diableries and temptations of reawakening Middle Ages.

No disguise, no landscape, covers up the hideous distortions brought about by

the transposition of a representation on a 'craticular ectype'. The dilated and fluid forms in movement are what fascinated Poe. The anamorphosis of the philosophers and mathematicians is ultimately swallowed up in a delirium of the disordered senses. It forms part of those strange visions which, for Poe himself, were engendered by opium and hovered over him like shadows.

The choice of the 'arabesque figures' of the tapestry was not accidental. Their existence was even qualified by 'alas' in the story for which they constituted the symbolic setting – 'alas', marking its aberrant and terrifying side. The fleeting image of a phantom pouring out fatal ruby-coloured drops into Rowena's goblet and the transformation of the corpse of the fair-haired Rowena into the raven-haired Ligeia, raised from the dead, prolong the same phantasmagoria in the same uncanny room. The whole story takes place in an anamorphic setting and background at a time when the system had reached its pinnacle of extravagance.

For some time we have been considering a complex period involving a return to an increasingly remote past. Vast repertoires were methodically explored and ancient schools provided a basis for documentation.

FIG. 84 J.-B. Lavit: anamorphoses on several planes, 1804

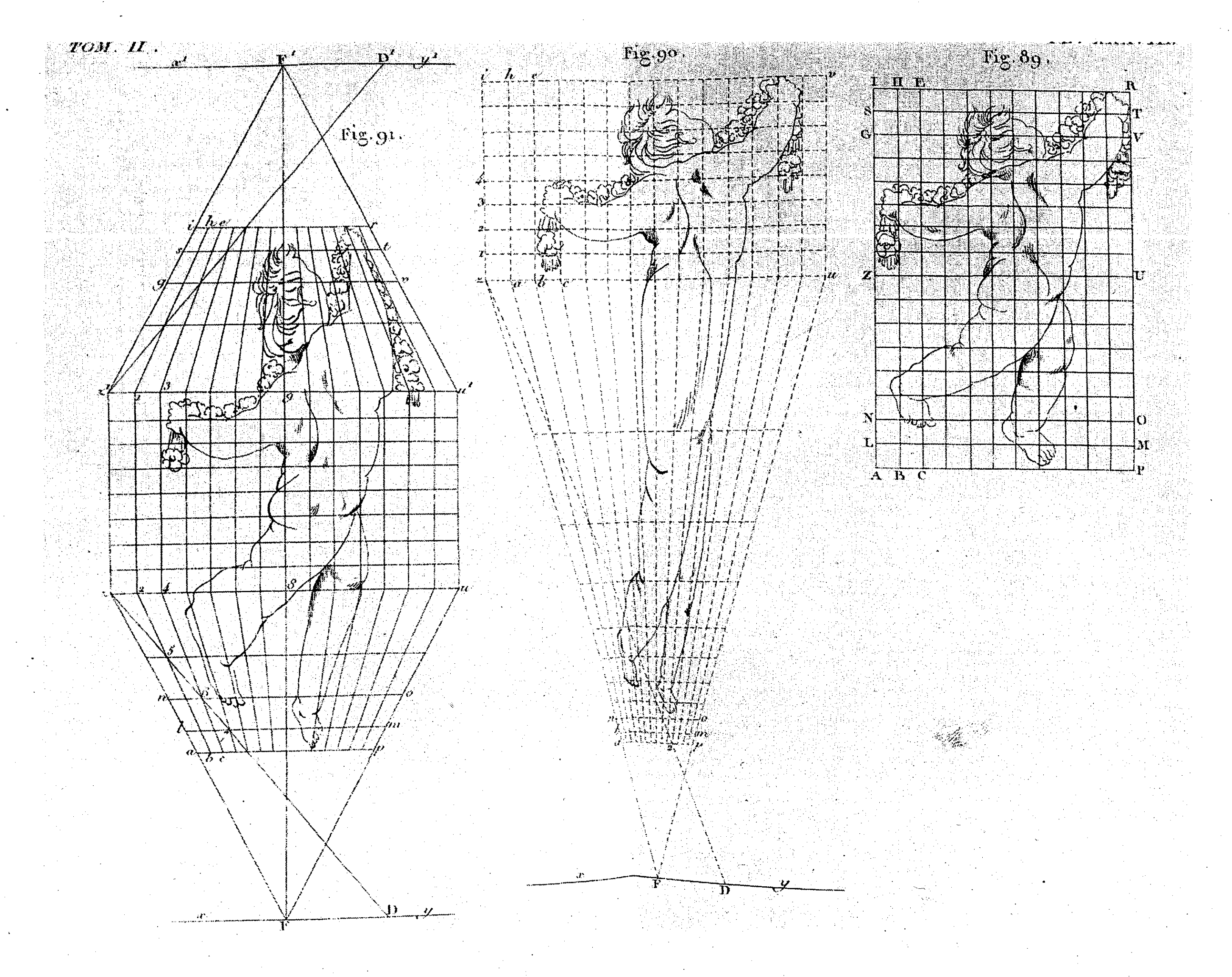
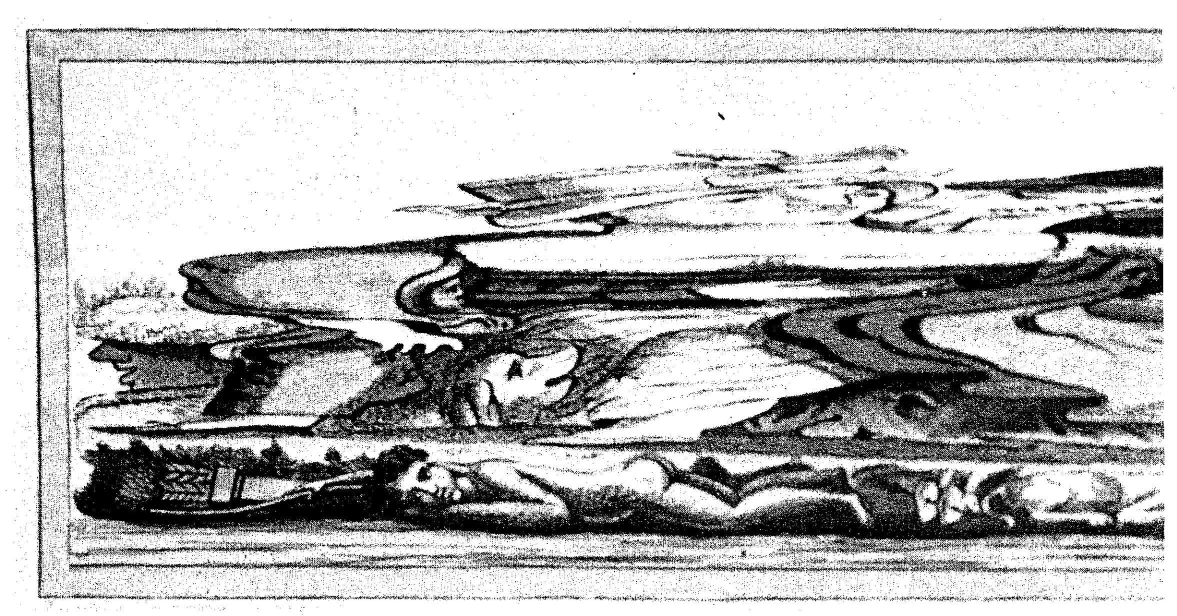




FIG. 85 Erhard Schön: perspective drawing (1543), reproduced by R. Becker, 1808

FIG. 86 Anamorphosis of a popular print: *Witchcraft scene*, 1804–14



The Basle *Dance of Death* was reproduced in 1789 (Basle), Holbein's version in 1832 (Munich), and the *Ambassadors* in 1791 in the first volume of J.-B. Lebrun's *Gallery of Painters*.[13] The miscellany of wood-engravings published by R. Z. Becker in 1808, contains a perspective plate by Schön in which men are reduced to solid geometrical figures, distributed on the squared grid of a *costruzione legittima* (fig. 85).[14] And Bartsch's description, quoted in Chapter Two, of two anamorphoses by Schön dates from the same year. We are in fact witnessing a revival of original 'states' and authentic forms. It seems more than likely that other optical engravings were made in France during this period.

Some popular prints deposited at the Imprimerie Nationale between 1804 and 1814 were directly inspired by primitive works, with gothic diableries. One print shows a landscape with distorted furrows and rocks and boulders in the shapes of human and animal heads (fig. 86). Restored to normality, the composition reveals a witch. The vigorous and incisive character of the drawing, the disturbed surface of the fields and hills full of hidden people, as well as the arrangement of the grotesque figures in the foreground, are very close to the art of the first half of the sixteenth century.

Subjects from a later period than the primitives were also revived spontaneously during the nineteenth century. J.-J. Grandville, who has been called one of the immediate precursors of the visionaries of our time filled his *Another World* (1844) with dwarfs and giants with shrunken and swollen limbs, or with basset-hounds, as depicted in the 'curious perspectives', without, however, following their precise calculations (fig. 91).[15]

The anthropomorphic landscape which, as in Kircher, was projected with the aid of a distorting mirror, reappeared simultaneously in Nuremberg and in Paris.



FIG. 87 *Anamorphic landscape*, C. Fortier, 1810–20

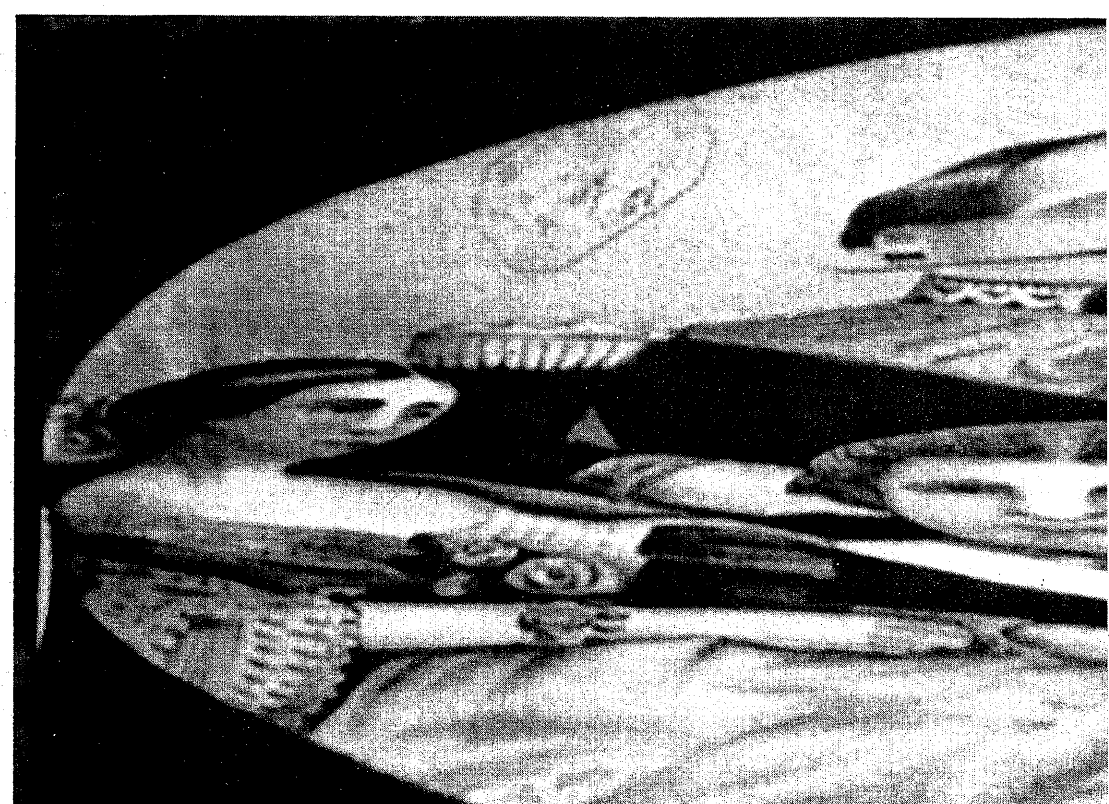


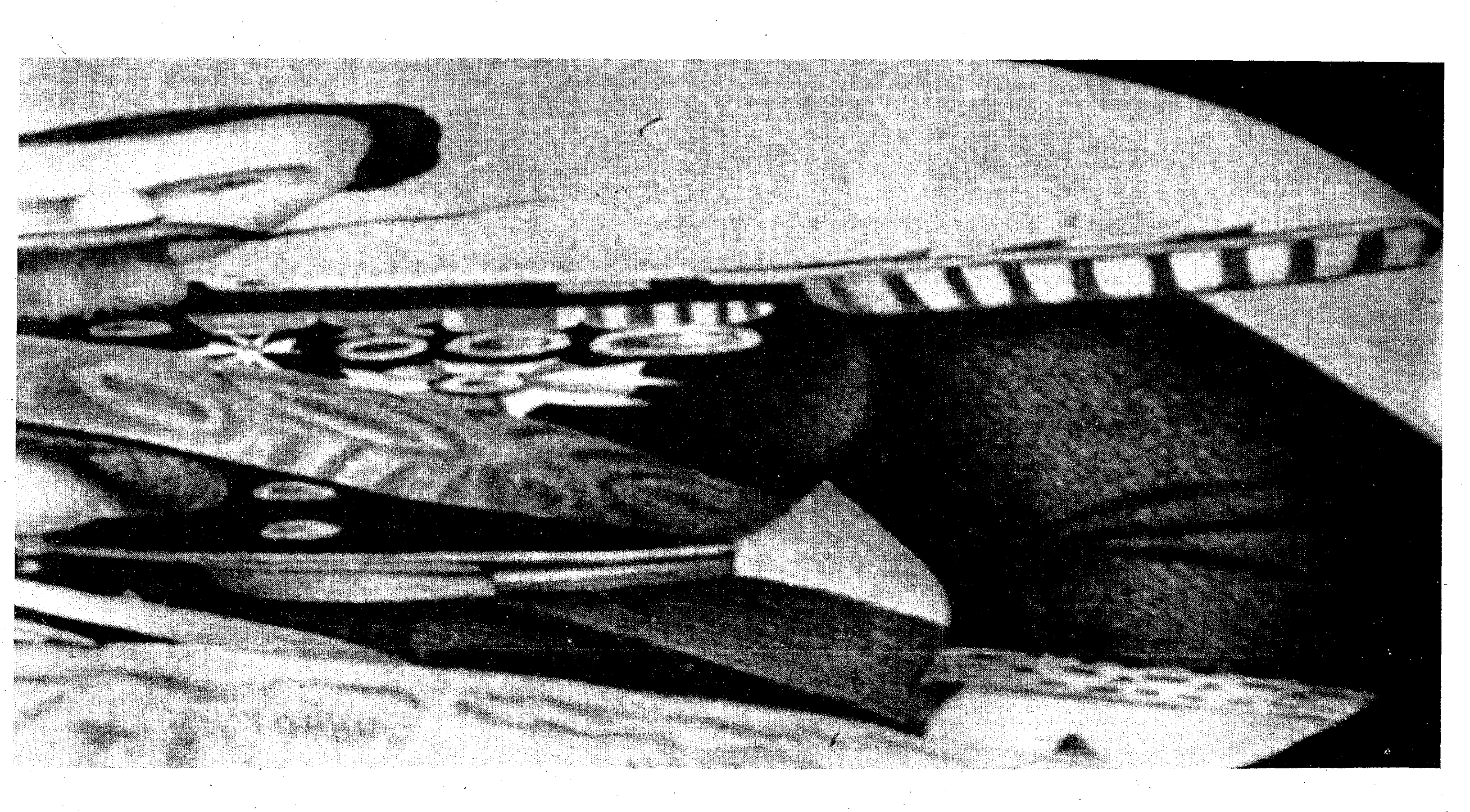
FIG. 88 Late example of anamorphosis: *Napoleon III*, from Decugis's bookshop. Marseilles, 1868

In the Nuremberg example (1815), the facial features are modified.[16] The design represents Napoleon, his profile concealed in a cliff and in the ruins of his huge castle which serves as a lair for bandits. The French engraving, however, differs little from that in the *Ars Magna*, the Roman garden with its little houses and the mountain forming a bearded face. A series of prints sold by L. Dubois, about 1810–20 and some of which bear the signature 'C. Fortier', are faithful reproductions of an engraving or painting by Arcimboldi (fig. 87). The commentary recalls the vanity of existence and the constant transmutation of things.

> Time which destroys all gives life to all,
> From the ruins that you see was I born.

It is not a matter of survival in an unbroken line, but of a revival of successive sources. 'The curious malady of the time, the mania for the Gothic' to which Jules Michelet refers in his preface to the *History of France in the XVIth Century*, written in 1855, was not limited to the Middle Ages. There was a return to wider fields and to forms which outlasted that period, while the process of enrichment continued. The contributions of the sixteenth and seventeenth centuries often merge and are regrouped in a coherent whole.

This strange restoration of primitive cycles during the decline which had persisted since the eighteenth century also produced elongated figures. For a long time



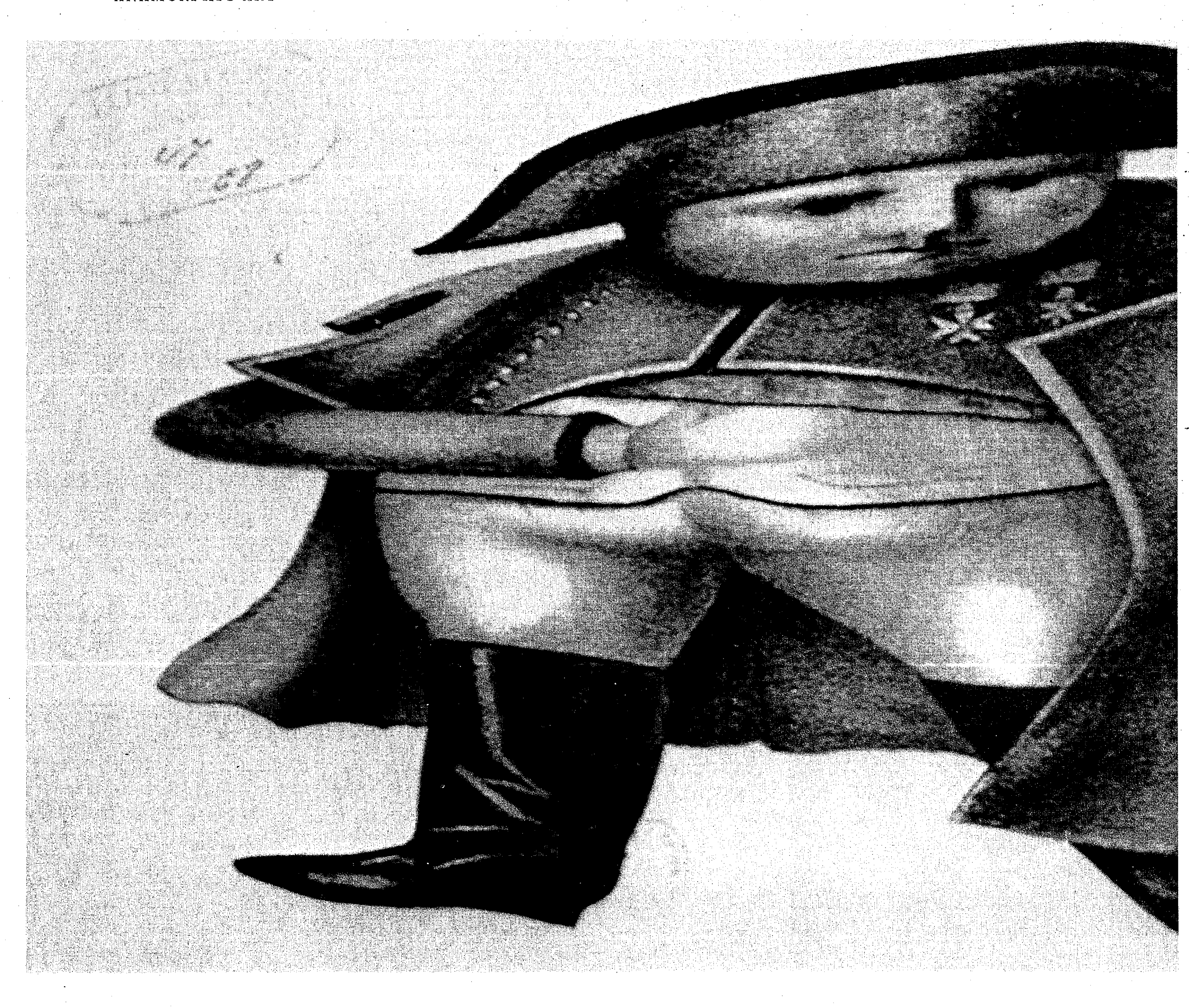
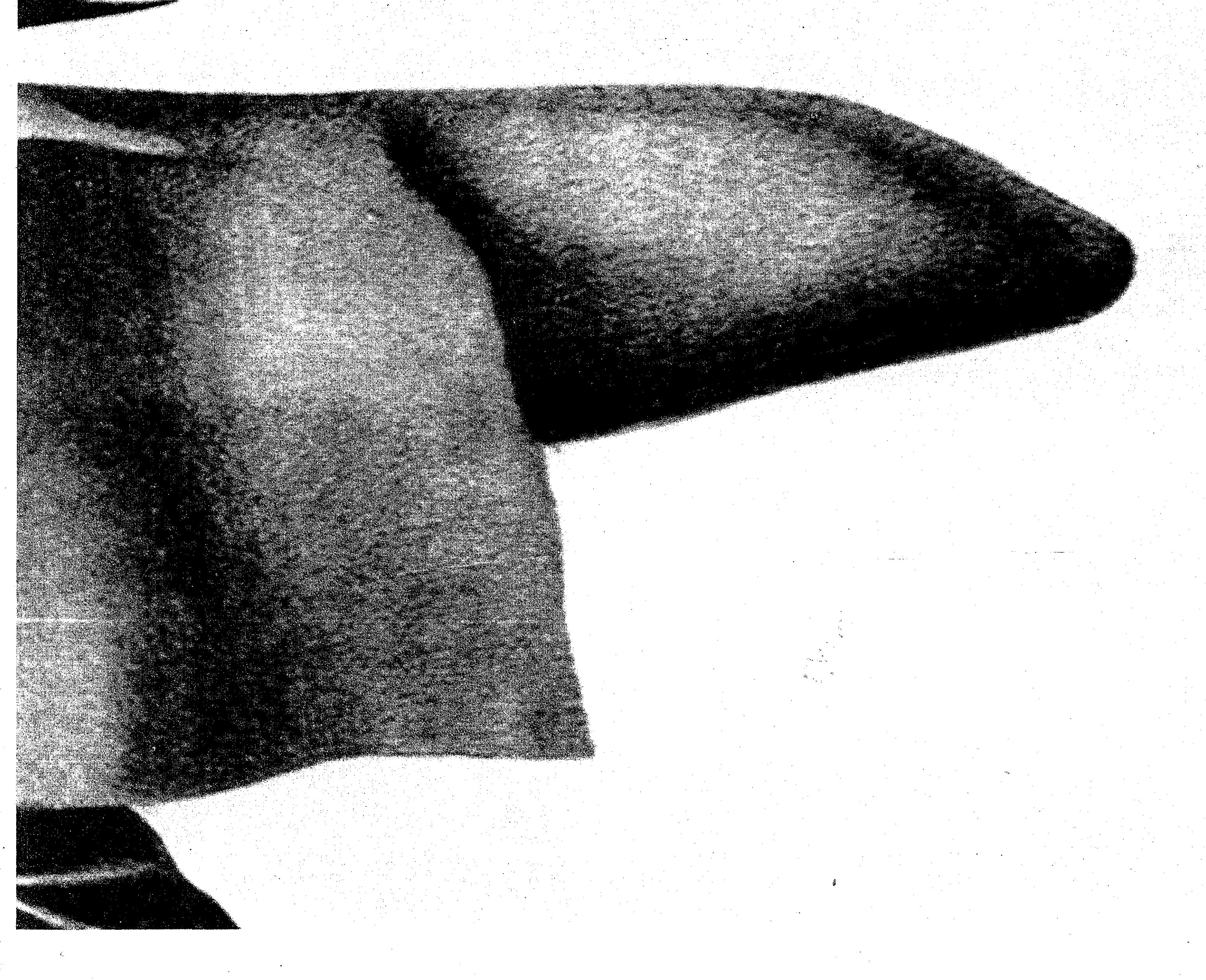


FIG. 89 Late example of anamorphosis: *Napoleon I*, from Decugis's bookshop. Marseilles, 1868

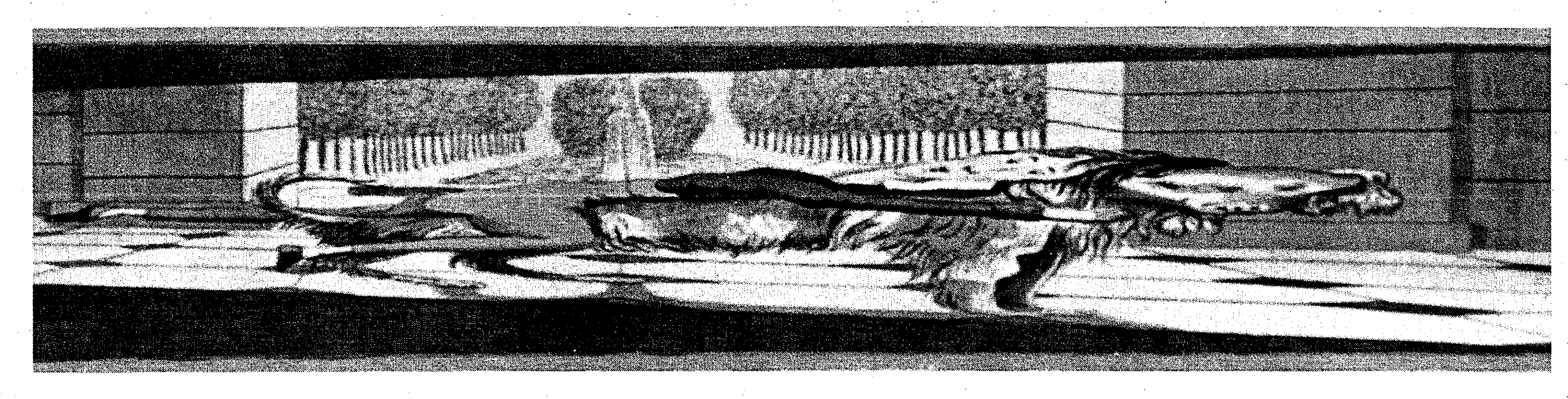
optically distorted prints with concealed subjects – as described by Barbaro – continued to be produced, but their themes became more and more trivial. However, these compositions never cease to surprise. A set of lithographs which bear the imprint of the Librairie Decugis of Marseilles and which date from 1868 (figs. 88 – 90) show Napoleon I, Napoleon III, musicians, wrestlers, dancers and obscene subjects, unpretentiously drawn but in strong relief and with a strange confusion of full and solid masses.[17] This abstract art with its egg-shaped forms already evokes a Henry Moore sculpture. A procedure elaborated over the centuries always produces the same results. Similarly, technique can revitalize themes: the portraits of sovereigns and the somewhat indecent pictures signed



by Schön had been published in Nuremberg before 1540 by Stefan Hammer. A German publisher of the sixteenth century and a French bookseller of the nineteenth launched the same kind of book. In the general history of printing, this astonishing repetition confirms the continuing interest of the subject, with periodical revivals exercising an influence of unlimited duration.

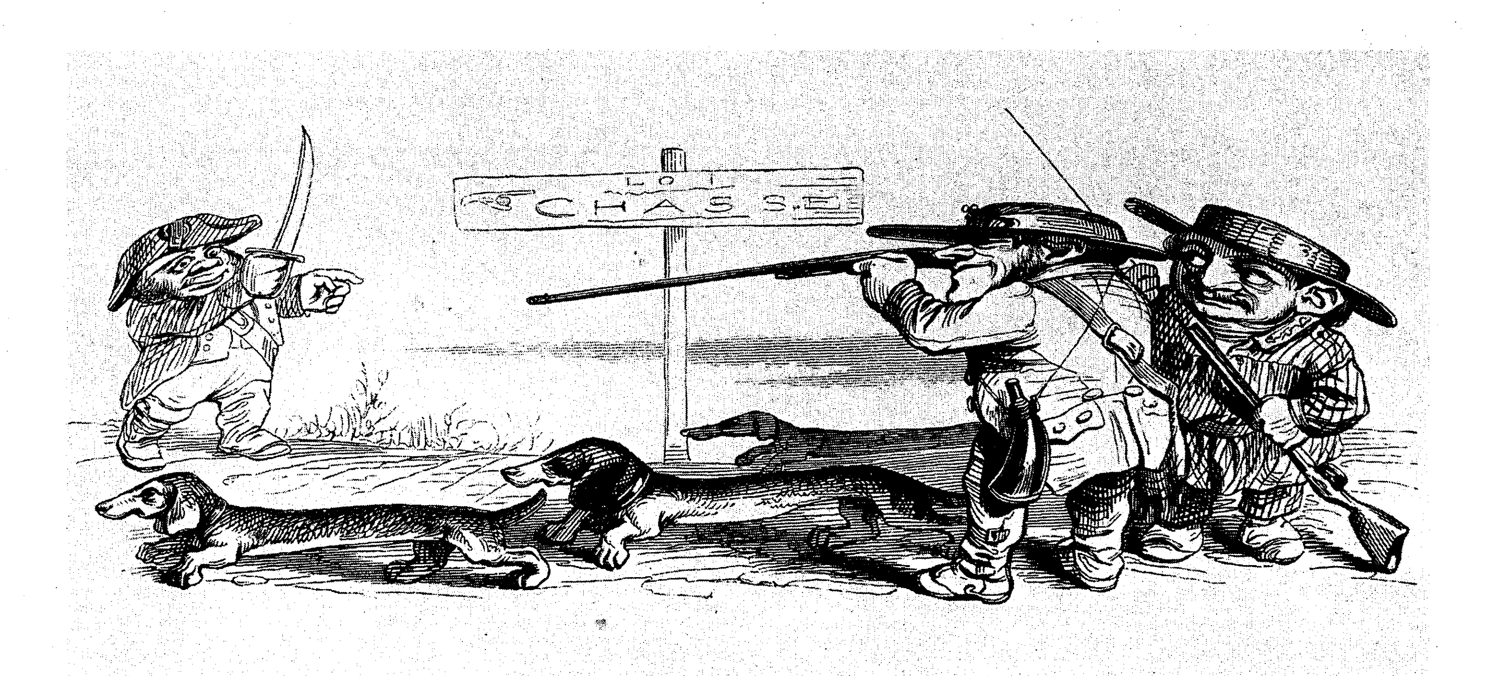
Reduced to a curiosity and a diversion, then restored under the influence of popular romanticism, anamorphosis ended up in cheap and popular illustration, but without losing its character. Somehow, it preserved its power and continued to reflect the sense of the marvellous which had formerly impressed a great many different circles. Modern art critics have been struck by this fact and have linked

FIG. 90 Late examples of anamorphosis: Dancers and musician, from Decugis's bookshop. Marseilles, 1868



anamorphosis with Surrealism.[18] There is no doubt that anamorphosis contributed to the overturning of forms which opened up the way to every sort of deviation; but the resemblance is only superficial. The geometrical and fantastic dreams of our time have their roots in a spontaneous order or disorder. They often form a spiritual link with previous cycles. When the late Jacques Lipchitz bought his two examples of anamorphosis, he saw in them the same mixture of abstraction and life that he had been seeking himself but which he expressed in his own way. He was impressed too by their singularity, by their mysteriousness, qualities which have always intrigued human beings and which, therefore, have been an important contributing factor in the influence that these marvels exercise.

FIG. 91 Anamorphosis and distorted image
a. Anamorphosis of a popular print: *Dog in a garden*, 1804–14.
b. J.-J. Grandville, *Another World*, 1844



CHAPTER NINE
Mirror anamorphoses

Among the anamorphoses of the past, which were rediscovered in the course of the eighteenth century, there was not only Holbein's *The Ambassadors* but also the expanded portrait of Edward VI (fig. 11) which at that time was at Somerset House.[1] Horace Walpole (1762) was impressed by the picture, as had been the German traveller Hentzner, who had come to England in 1598 in Shakespeare's time.[2] Walpole had, moreover, just published his edition of Hentzner's *Itinerarium* (1757).[3] However, his interpretation of the optical mechanism of the composition differs. He believed that rectification occurred, not by viewing the picture obliquely, but by seeing it reflected in a cylindrical mirror.

Walpole's error was due to a new system then in vogue in which direct anamorphoses were replaced by catoptric (mirror) anamorphoses. A contemporary text, Diderot's *Encyclopaedia* (1751), explained how it worked: 'As cylindrical and pyramidal mirrors possess the property of distorting things exposed to them and, in consequence, they can make distorted objects appear natural, in optics too there are means of drawing on paper distorted objects which, seen through this kind of mirror, appear in their natural form.'[4]

The catoptric method involves breaking up the image around a cylindrical or conical mirror so that, by virtue of the laws of the angles of incidence of reflection, it is reconstituted on a convex surface which diminishes and corrects the curves. The effect is more exact and striking and more surprising, too, than in the early versions, since the subject in its reconstituted and distorted forms is seen from the front at the same time, whereas in the case of elongated perspective, it is necessary to shift one's position. It is comparable to the effect of an automaton causing pictures to arise directly out of a confused tangle.

We know of a very large number of such works which fascinated the most varied circles. L. Dimier has drawn attention to twelve coloured etchings in cylindrical perspective, representing country scenes, horsemen, peasants, wrestlers and a ship flying a Dutch flag, which he assigned to the eighteenth century.[5]

There are other examples.[6] The Musée des Arts Décoratifs in Paris possesses pen drawings with water-colour wash which are anamorphic allegories of the Four Continents, dated 1740. The monogram EBAH is that of Elias Baeck, alias Heldenmuth, an artist from Corinthia living in Augsburg.[7] There are eighteenth century

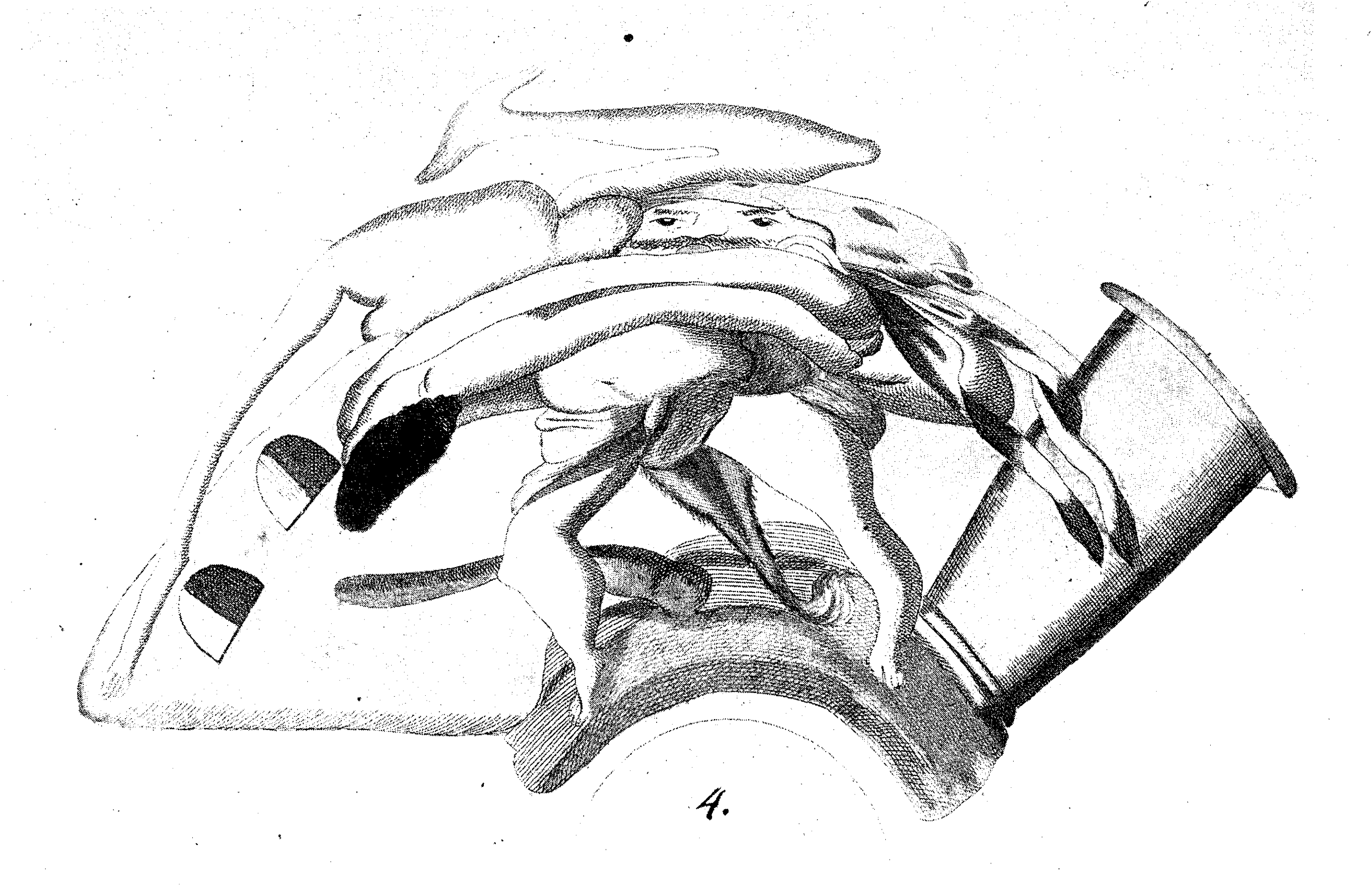


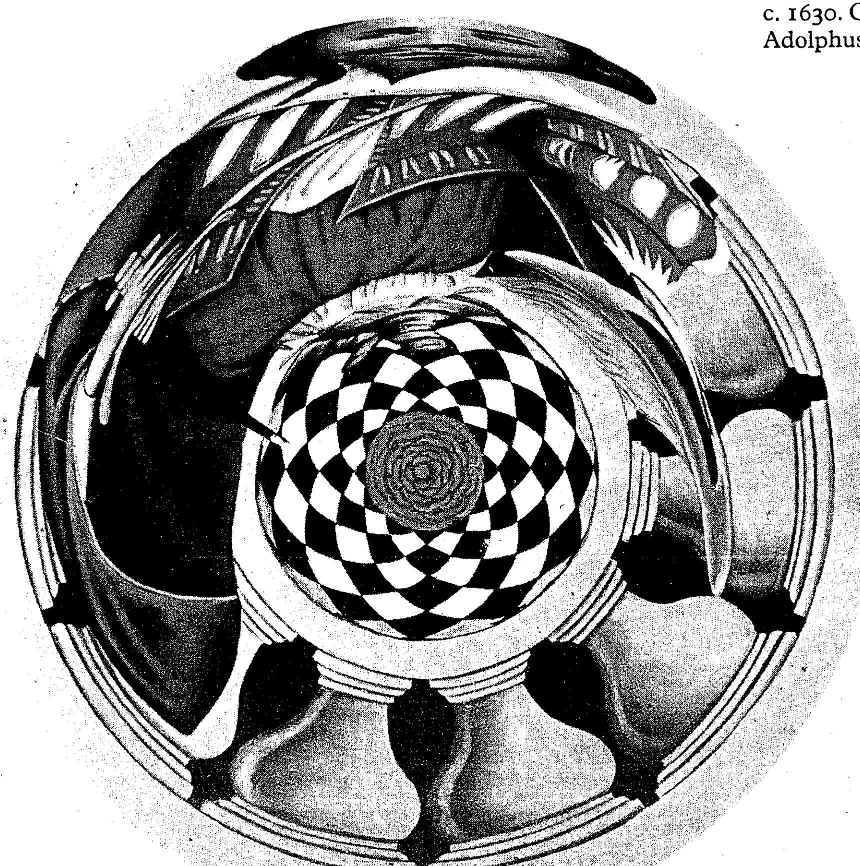
FIG. 92 Cylindrical anamorphosis: *Wrestlers*, coloured engraving, German (?), 18th century. Philadelphia Museum, USA

German engravings representing Pyramus and Thisbe and genre scenes in the Philadelphia Museum.[8] With their baroque elongations, the grotesque combined with an affected mannerism, they belong to a similar large group (figs. 92 and 93).

But there were also painted panels. The inventories of collections and old museums frequently recorded them. 'Cylinders of polished metal which reduce casually drawn lines to correct proportions' featured, among other things, in the Grollier de Servières Collection in Lyons which was twice visited by Louis XIV in 1658.[9] The Settala Museum in Milan possessed two cylindrical anamorphoses in 1664.[10] Secret portraits of Frederick III (1648–70) and of the Queen of Denmark and Norway, similar to that of Charles I of England (fig. 73) are recorded at Copenhagen (1696).[11] We also know that Olaus Worm, a doctor in the same town, owned conical and cylindrical mirrors in 1655.[12] In the case of cones, the optical images were painted on the inside of round boxes which encircled the mirror. Monks, naked maidens and skeletons were the subjects. There is also in existence a portrait of Cardinal Richelieu, whose presence implies a French origin for the whole series. Finally, a circular brass plaque with a bearded personage extended round a cylindrical mirror is preserved at Uppsala in the *Kunstschrank*, the collection of Gustavus Adolphus. An inventory of 1698 describes an anamorphic oil painting of the same dimensions, while Philipp Hainhofer, the Augsburg art-collector and dealer who delivered the piece to the King in 1632, related that in 1629 in Dresden he bought mirrors that 'reflected strange faces in perspective'.[13] If this refers to the bearded figure, it must be one of the oldest mirror anamorphoses which has come down to us. The character of the composition does suggest an early date (fig. 94).

FIG. 93 Cylindrical anamorphosis: *Horseman*, coloured engraving, German (?), 18th century. Philadelphia Museum, USA

FIG. 94 Cylindrical anamorphosis: *Man with a beard*, painting on copper, Germany, c. 1630. Collection of Gustavus Adolphus, Uppsala, Sweden



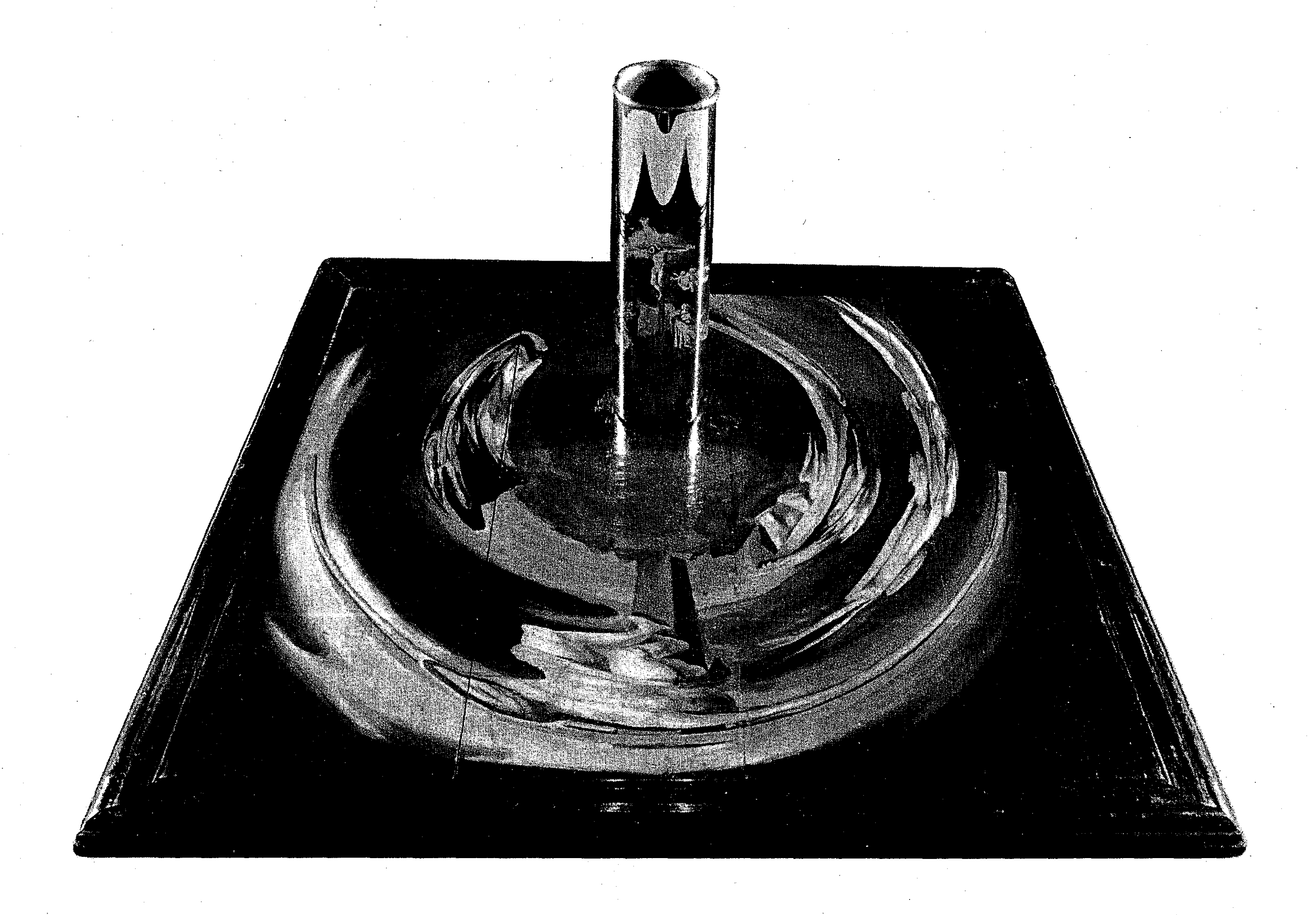


FIG. 95 Cylindrical anamorphosis: *Crucifixion*, painting on wood, Dutch School, c. 1640. J. Elffers Collection, Amsterdam (formerly Korteweg Collection)

A Dutch *Crucifixion* (fig. 95) which physical evidence assigns to a date before 1640, also belongs to one of these early periods. However, even at this early date, it shows an exaggerated and distorted geometricization in its three concentric strips which resemble crescent moons. The scene at Calvary which appears in the cylinder leaps up as by magic from a triple whirlwind. Two Flemish anamorphoses from the second half of the seventeenth century, one from the Rheims collection (Paris), the other from the Rouen Museum (H. and S. Baderon Collection), reproduce the *Erection of the Cross* after the Rubens painting (1610–11) in Antwerp Cathedral. The figures emerge not from a linear rotation but from a confusion of spots where everything appears to be in disorder. If one places oneself on the opposite side of one of these compositions, the same cylinder reflects a pair of lovers drawn opposite the *Crucifixion* like a demonstration of a secret code (fig. 96).[14]

FIG. 96 Cylindrical anamorphosis: *Erection of the Cross*. Flemish school, second half of 17th century. H. and S. Baderon Collection, Museum of Fine Arts, Rouen



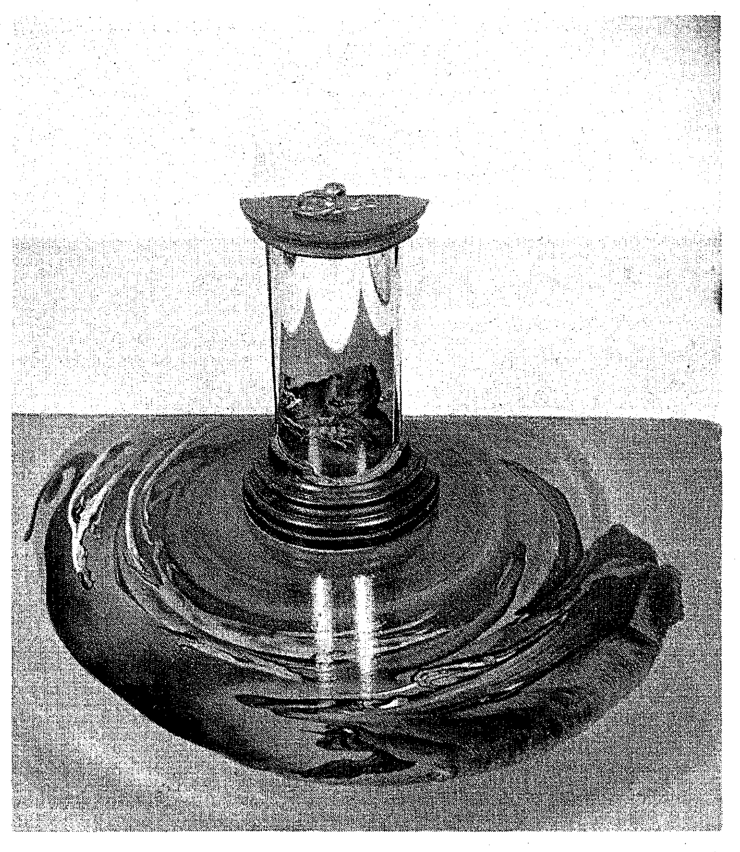


FIG. 97 Cylindrical anamorphosis: *Hunting scene*, signed H. Kettle, 18th century. Leyden Museum



FIG. 98 Cylindrical anamorphosis: *Musician*, Netherlands, 18th century. Leyden Museum

Paintings devised for such catoptric arrangements are still numerous in museums and in modern collections.[15] The Leyden Museum of Natural Science has gathered together some remarkable examples (figs. 97–100), and an important group, no doubt executed in a similar workshop in the Low Countries, and associated with the name of a certain Henry Kettle, was acquired in Amsterdam in 1939 by a New York collector.[16]

This consists of a set of ten anamorphoses – five intended for the cylindrical, five for the conical mirror. There are two mythological scenes (*Venus and Adonis*, *Cupid and Psyche*), two musical scenes, two scenes depicting women with birds, a peasant woman riding a donkey, and three animal pictures – wild boars, eagles and a monkey.





FIG. 99 Conical anamorphosis: *Horseman*, Netherlands, 18th century. Leyden Museum

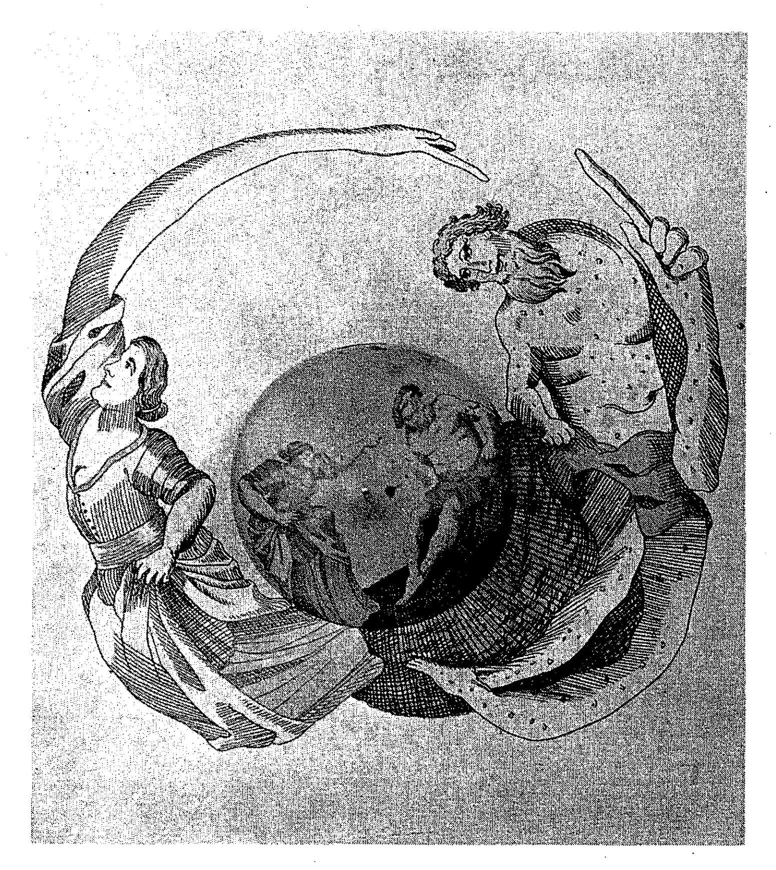


FIG. 100 Conical anamorphosis: *Mythological scene*, Netherlands, 18th century. Leyden Museum

In the cylindrical perspective, the figure – with a few exceptions – does not occupy the complete circle, and the mirror, placed vertically in the centre, reflects only the picture at one side. The latter is not stretched out upwards. It expands and unfolds, like a fan. But the effects of these distortions are always surprising. The woman with a bird in a cage melts like wax (fig. 101). Her head droops, her features become liquid and flow slowly and gracefully. Similarly distorted, the musicians whirl round like a tuft of feathers (fig. 102). Animals turn into shell-fish. The recumbent Psyche arches her back (fig. 103). Her pale limbs are elongated, drawn out as in a nightmare. A rotary movement seems to remove the bones from her body. The trees seem to take flight under the curtain, their leaves tracing streaks, as if seen from the windows of an express-train.

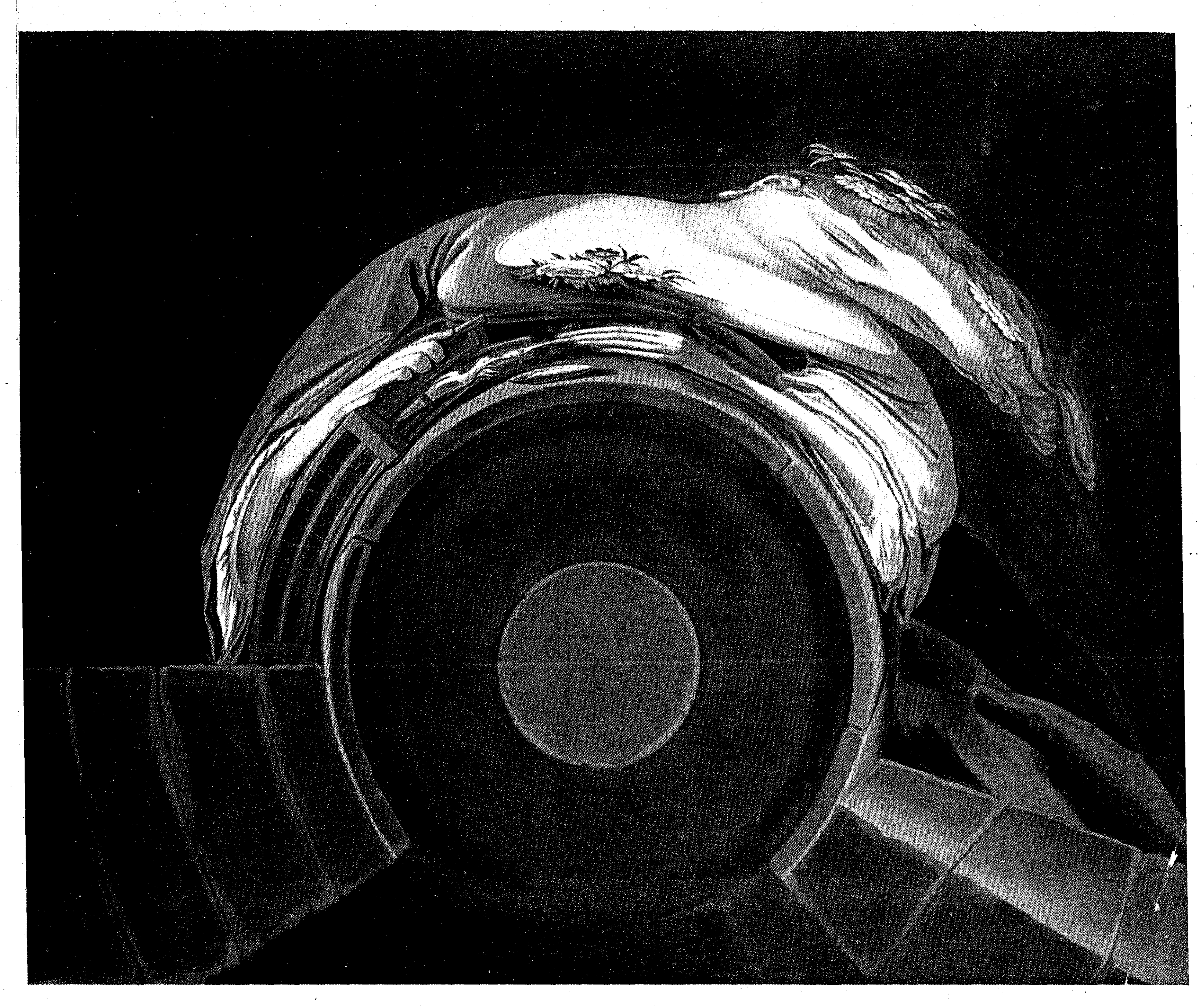


FIG. 101 Cylindrical anamorphosis: *Woman with a bird in a cage*, Netherlands, 18th century. Milan, private collection (former H. Tannenbaum Collection)

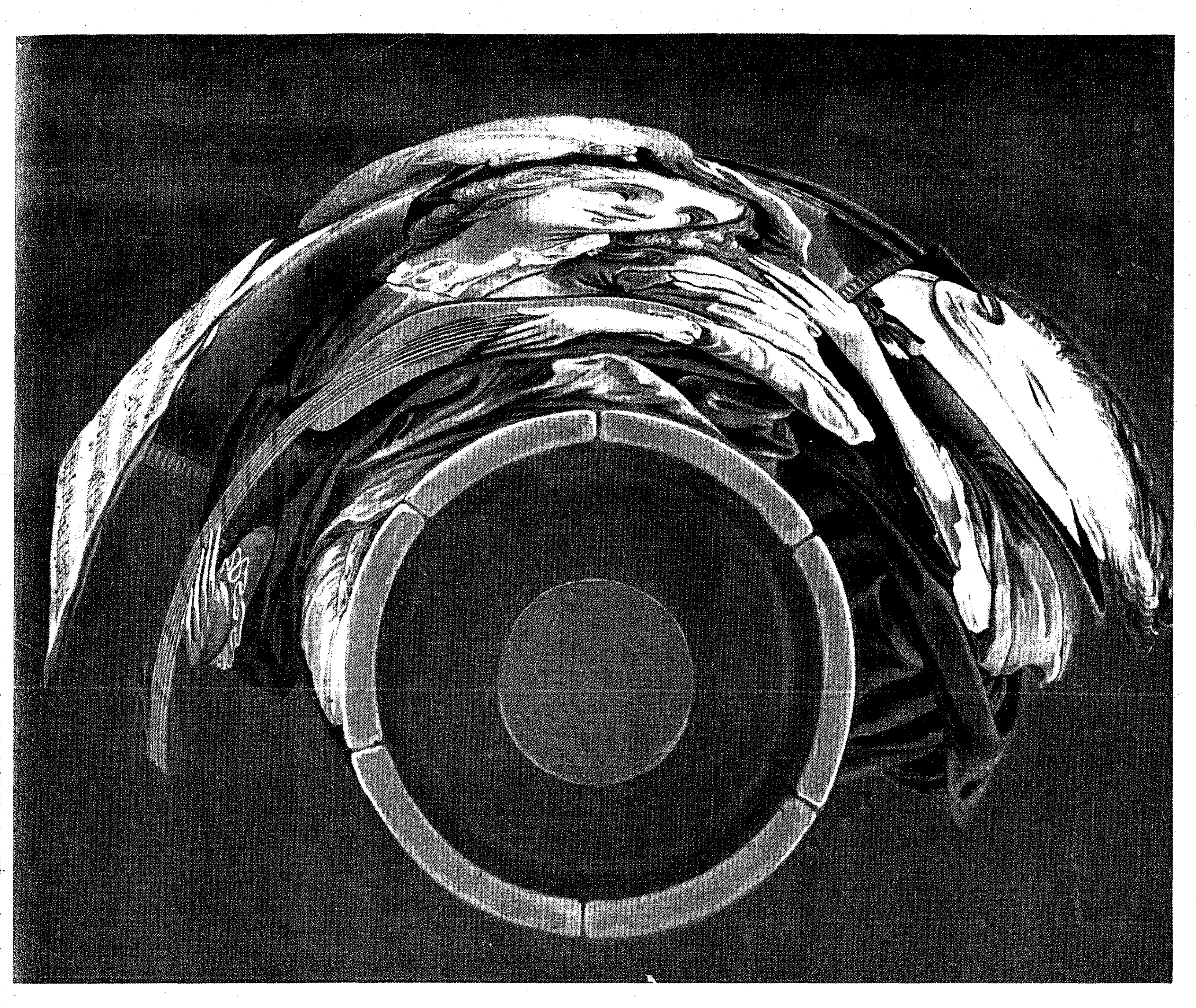


FIG. 102 Cylindrical anamorphosis: *Lute-player and a woman with a music score*, Netherlands, 18th century. Milan, private collection (former H. Tannenbaum Collection)

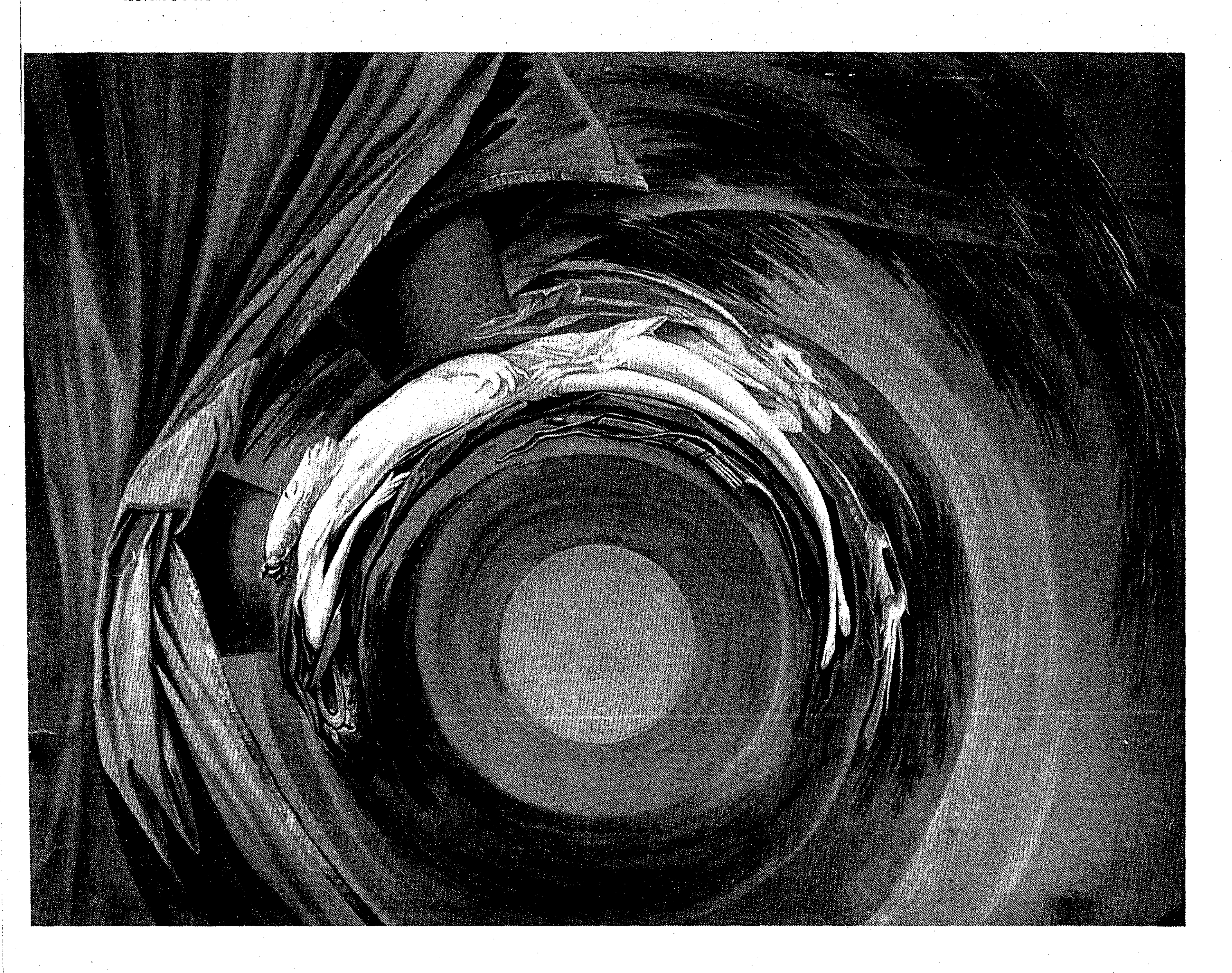


FIG. 103 Cylindrical anamorphosis: *Cupid and Psyche*, Netherlands, 18th century. Amsterdam, J. Elffers collection (former H. Tannenbaum Collection)

FIG. 104 Conical anamorphosis: *Woman with a bird*, Netherlands, 18th century. Amsterdam, M. Schuyt collection (former H. Tannenbaum Collection)

In conical perspective, constructed round a whole mirror which corrects the original pictures when viewed from the apex, the arrangements are even more extravagant. There is more than a circular expansion. Since the centre of the composition relates to the periphery, the anamorphosis opens like a flower, and breaks up the image. The world bursts asunder before reconstituting itself. The heads, the limbs are detached from the body and are then reinstated. Thus, the woman who is holding a bird by a thread is split into three pieces (fig. 104). Two arms emerge from two separate heaps of drapery. The face is upside down and fluid. At the top it becomes a luminous trail, lengthened by a halo bordered with ringlets and roses. Heavy drapery swells around the circle, indicating the base of the cone. Illumined against a sombre background, the vision seems to emerge from the night.[17] It is an almost cosmogonical picture with mysterious signs turning

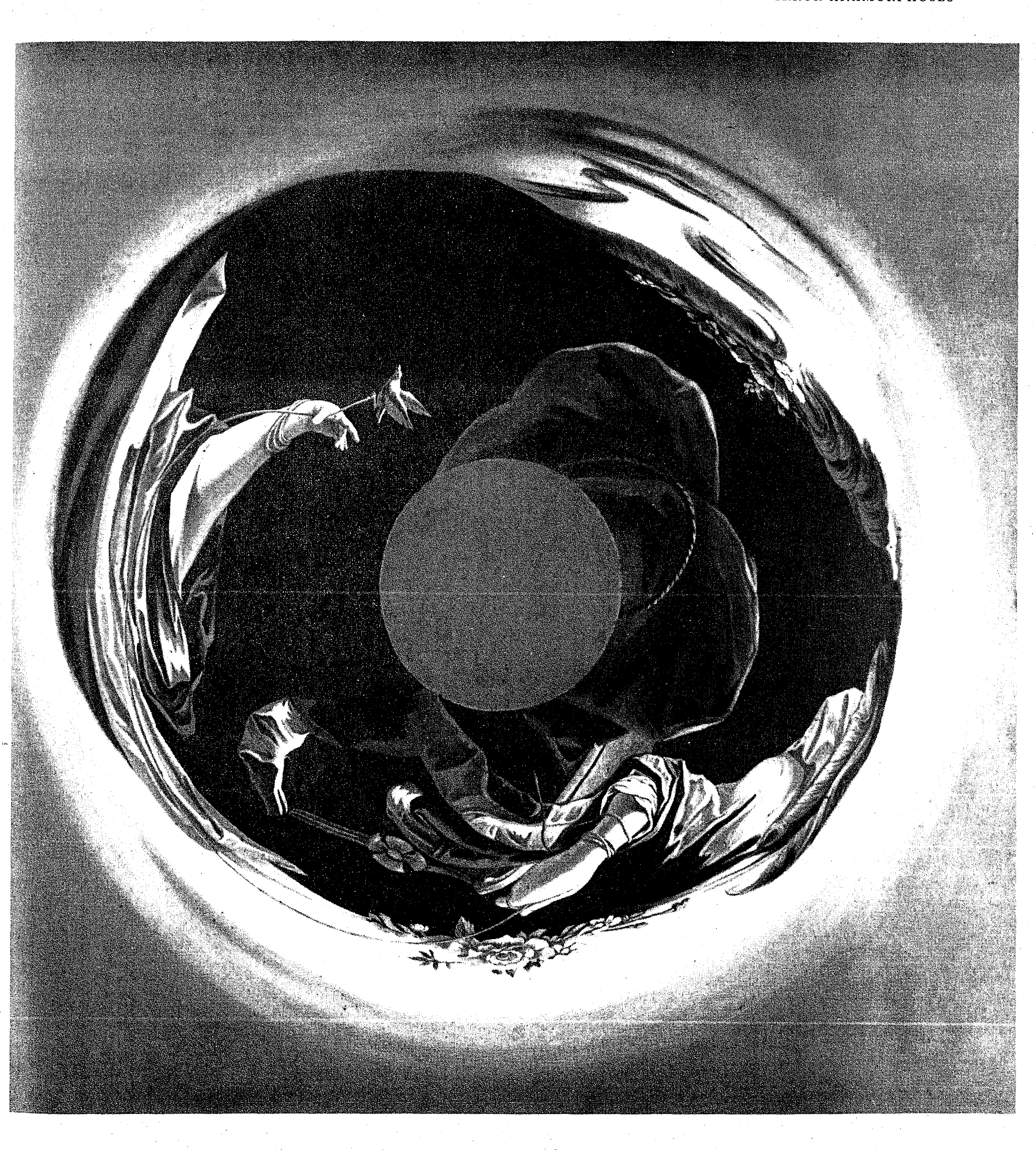




FIG. 105 Cylindrical anamorphosis: *Par une tendre Chansonnette*, Netherlands, 18th century. Milan, private collection (former H. Tannenbaum Collection)



FIG. 106 Nicolas Lancret: *Par une Tendre Chansonnette*, c. 1730. Fitzwilliam Museum, Cambridge, England

within spheres. If we think of the operation in reverse, the mirror is projecting the aberration of natural forms. Visionaries of all times must have enjoyed these transfigurations which reveal the fantastic element. The correction in the mirror, wherein true forms are reborn from chaos, also possesses this supernatural element. The forms no longer reappear on a smooth surface but in an infinite depth which is revealed simultaneously in the dazzle of the metallic reflection. The image springs into life. It moves, it changes at the slightest shift of our gaze. It evolves in the realm of fairyland where all things are at the same time present yet inaccessible.

The subjects of these anamorphoses are borrowed from different pictures, some of which can be identified. Thus, the scene with a man playing a flute in front of a lady seated in a garden between another woman and a negro boy (fig. 105) is a copy of Lancret's painting *Par une tendre chansonnette* (fig. 106) which has often been engraved – by Charles N. Cochin and G. F. Schmitt among others.[18] These works

therefore cannot be assigned to a date before 1730, although they do repeat older models. Among them we find groups of animal-painters of the seventeenth century, such as Paul de Vos, Jan Fyt, often represented in these compositions (fig. 107). The monkey with an overturned basket is borrowed from Frans Snyders, *Venus and Adonis* is from Simon Vouet (figs. 108 and 109.)[19] The original, from the Crozat collection, is at present preserved in the Hermitage in Leningrad. Copies were made on a panel in the Hôtel de Bullion and in tapestries. Dorigny, the artist's son-in-law, engraved the painting in 1638 (fig. 110) and again in 1643.[20] The scene,



FIG. 107 Conical anamorphosis: *Owl defending its young against an eagle*, Netherlands, 18th century. Milan, private collection (former H. Tannenbaum Collection)

FIG. 108 Cylindrical anamorphosis: *Monkey with an overturned basket confronted by a dog*, Netherlands, 18th century. Milan, private collection (former H. Tannenbaum Collection)

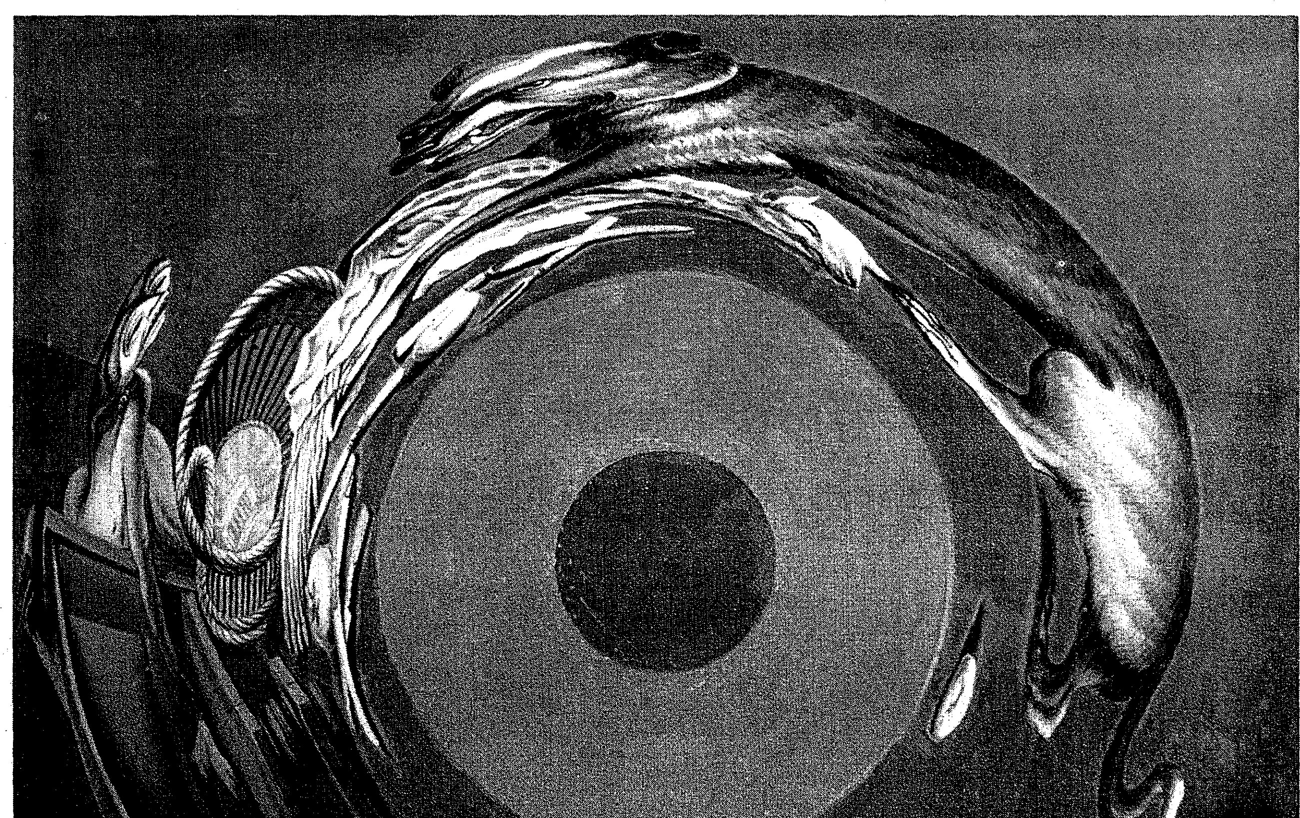




FIG. 109 Conical anamorphosis with a mirror recomposing the picture in the central medallion: *Venus and Adonis*, after Simon Vouet, Netherlands, 18th century. Milan, private collection (former H. Tannenbaum Collection)



FIG. 110 Simon Vouet: *Venus and Adonis*, engraving by Dorigny, 1638

showing on the right the seated goddess opposing the departure of her lover for the chase, on the left two dogs and a Cupid, is enclosed in an oval which, in conical anamorphosis, becomes a circular medallion.[21] Distorted round the mirror, the beautiful classical figures assume a monstrous aspect. The youthful hero is bisected, his head down. His swollen limbs are turned around, his feet are in the air. The staff bends into a bow. Venus's arms resemble intestines. The whole is a strange whirlwind of scattered pieces and shapeless anatomical débris which are reformed and resolved with precision in the reflections of the cone, the apex of which is marked by a clasp on Adonis's cloak.

FIG. 111 Simon Vouet: anamorphic mirror with an elephant, engraving by Hans Tröschel, c. 1625

FIG. 112 Anamorphic mirror with Louis XIII, Vaulezard, 1630

The interest of this picture is not only in the reversion in the mid-eighteenth century to ancient models. It takes us back directly to Simon Vouet, a considerable artist who seems to have been closely bound up with the propagation of this art. Indeed, one of the first known images of catoptric mechanics, an engraving in which we see a large cylinder on a table, showing the anamorphosis of an elephant covered with a fringed saddle-cloth (fig. 111), bears his signature. Satyrs crowd around. Some point at the distorted drawing, others make gestures of surprise as they notice the elephant in the mirror. The scene takes place in a garden, with

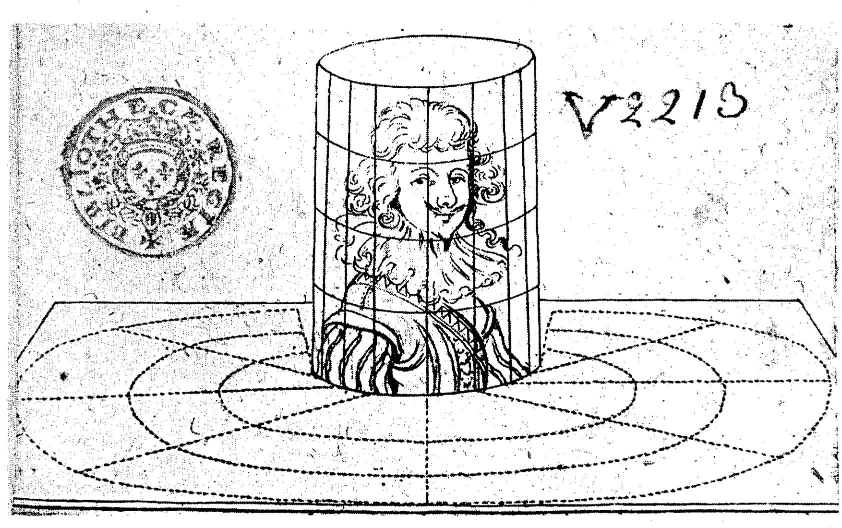




FIG. 113 Anamorphic mirror with Louis XIII, J.-F. Niceron, 1638

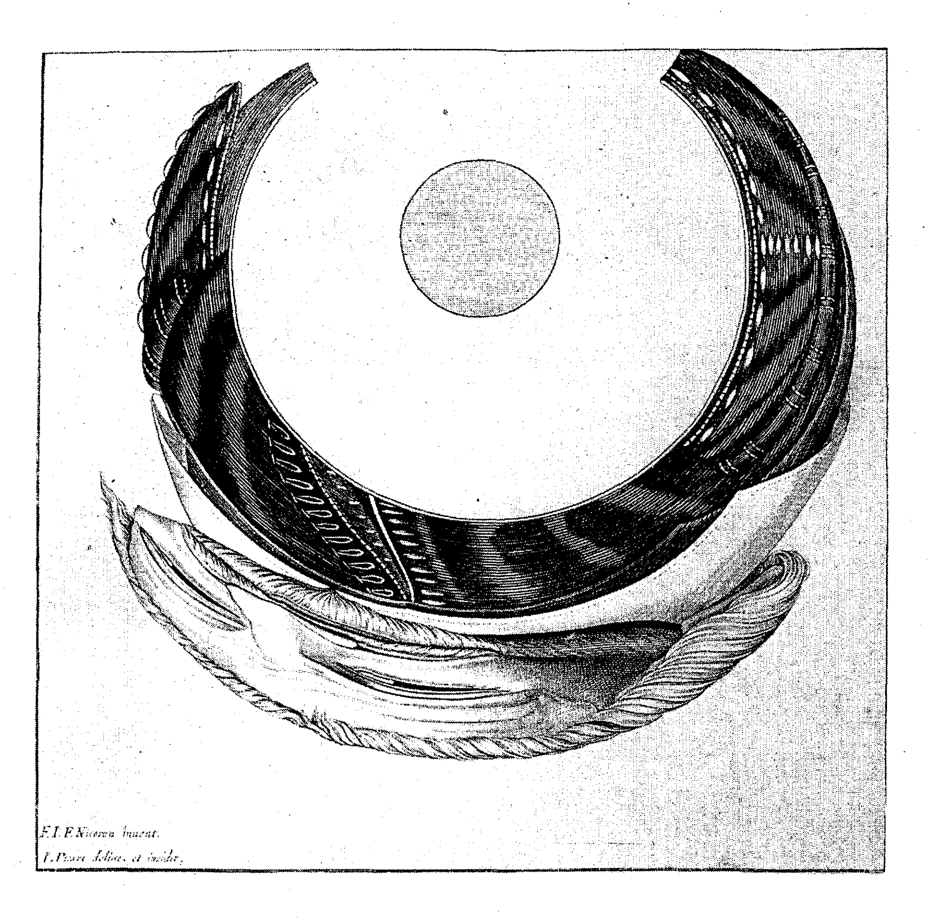


FIG. 114 J.-F. Niceron: *Anamorphic portrait of Jacques d'Auzoles*, 1631

long arbours and cypress trees in the background. The story unfolds like the presentation of some unknown wonder. A scroll bears the inscription: FORMAT ET ILLUSTRAT.[22] The plate bears two signatures: *Simon Vouet In.* and *Joan Tröschel Sc.*, which fix the place and time of its execution. The two artists could only have met in Rome: Hans Tröschel (1585–1628), a Nuremberg engraver arrived there in 1624 and Simon Vouet stayed there until 1627.

The engraving is one of the first illustrations of how the apparatus works and how these compositions are constructed. The first manual on the subject is not earlier than 1630. We owe it to Vaulezard, who himself states in the preface that 'no author has written about this before' and who introduces catoptric anamorphosis as a recent discovery. A cylinder similar to Vouet's, but with the elephant picture replaced by a portrait of Louis XIII, is reproduced on his title page (fig. 112). In 1637 Hérigone's *Mathematical Course* appeared; in 1638, Niceron's *Curious Perspective*, its frontispiece that same cylindrical mirror with that same monarch (fig. 113). The young Minim of the Cartesian centre of the Place Royale who made a considerable contribution to the development of this art had long practised it. Niceron's anamorphic portrait of Jacques d'Auzoles, 'prince of chronologists' (fig. 114), executed in 1631 when the artist was only eighteen, is one of the oldest drawings which we can date exactly.[23]

On his return to Paris (in 1627), summoned by Louis XIII, Vouet became particularly associated with this group of monks who had specialized in all branches of perspective, including catoptrics, under the influence of Fr. Mersenne. He painted

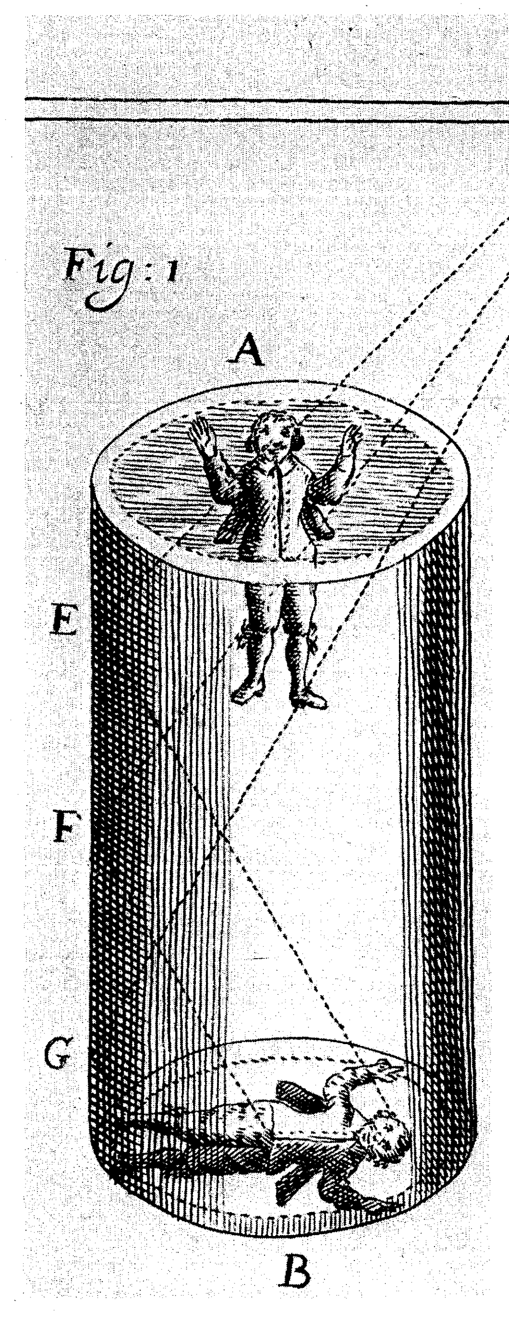


FIG. 117 Athanasius Kircher: cylindrical mirror causing an image to appear in the air, 1646

Inaugurated after 1615, the development of catoptric anamorphoses occurred in three stages: up to 1630, tentatively, showing no precise knowledge of geometrical procedures; from 1630 to 1637, a restatement in strict scientific terms; after 1638, a simplification and rationalization – that is, at any rate, how it emerges from the texts and explanations provided in the technical works.[33]

'The first to make figures for the mirror', said Vaulezard, 'did not do it correctly.' He himself undertook all the necessary calculations for which Hérigone was then to provide his own method. It is not possible to analyse here all the diagrams of linear frameworks, of grids for cylinders, of concentric circles for cones projected round the mirror and in which the chosen image is placed, reflecting in detail each fragment delimited by a compartment in the corresponding part, in which a square becomes a large segment of a circle and in which the segment moves and becomes enormously elongated so that 'a nose, an arm, a leg, even a whole body, looks like a mere thread.' Vaulezard and Hérigone were mathematicians and their formulae have an excess of precision and a complexity of function, inaccessible to most artists.[34] Therefore Niceron, while rendering homage to Vaulezard, the most erudite of all who wrote on the question, tried to simplify some of his methods.[35] Niceron affirmed that he found his solutions empirically, but stressed that the results were very satisfactory. All the people who witnessed their use in the library of the monastery at the Place Royale were well satisfied. The rudimentary methods, as well as the highly sophisticated ones, were followed by procedures that reconciled pure science with practical compromises (figs. 115 and 118).

Fascinated by their effects, Niceron was eager to introduce catoptric anamorphoses everywhere, even into architectural décor. They could be constructed in marquetry or mosaic, on floors around columnar mirrors incorporated in the building.

> It will be a new wonder when, after seeing the shafts of these columns sparkling with light – because of their fine polish – and free of any image or painting, you see pictures or other representations gradually surge up as you approach . . . such figures could be conveniently constructed at the top of the decoration of a fireplace, bordered at each side by a column or a cylindrical mirror, harmonizing with its architectural style, which would serve to unite and to reflect the kind of figures set up for that purpose.[36]

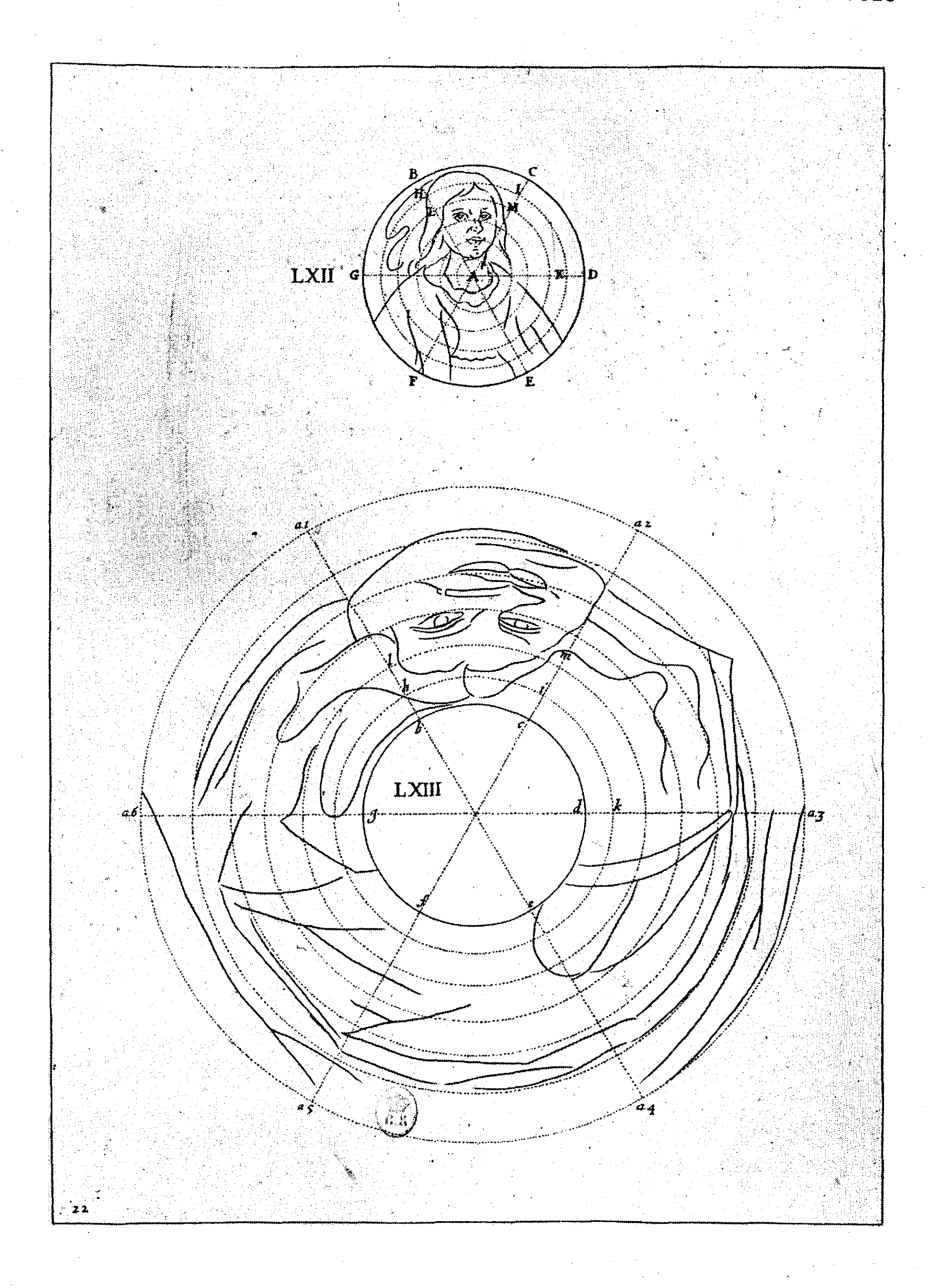


FIG. 118 J.-F. Niceron: geometrical diagram of a conical anamorphosis, 1638

Furthermore Niceron suggested the suspension of conical mirrors in ceilings and in rococo grottoes, 'so that anyone who found himself directly under the apex of the mirror and raised his eyes would see a well-proportioned image rise from a confusion of lines and colours, set there haphazardly and as though without plan.' The frontispiece of *Curious Perspective* (1638) shows an example of one such suspended from the underside of a triumphal arch. In Fr. Du Breuil's treatise (1649), however, we find a more complete demonstration of these architectural arrangements.[37] In the same way as direct anamorphoses on plane, pyramidal or conical surfaces (fig. 35), so catoptric anamorphoses figure in galleries in which we

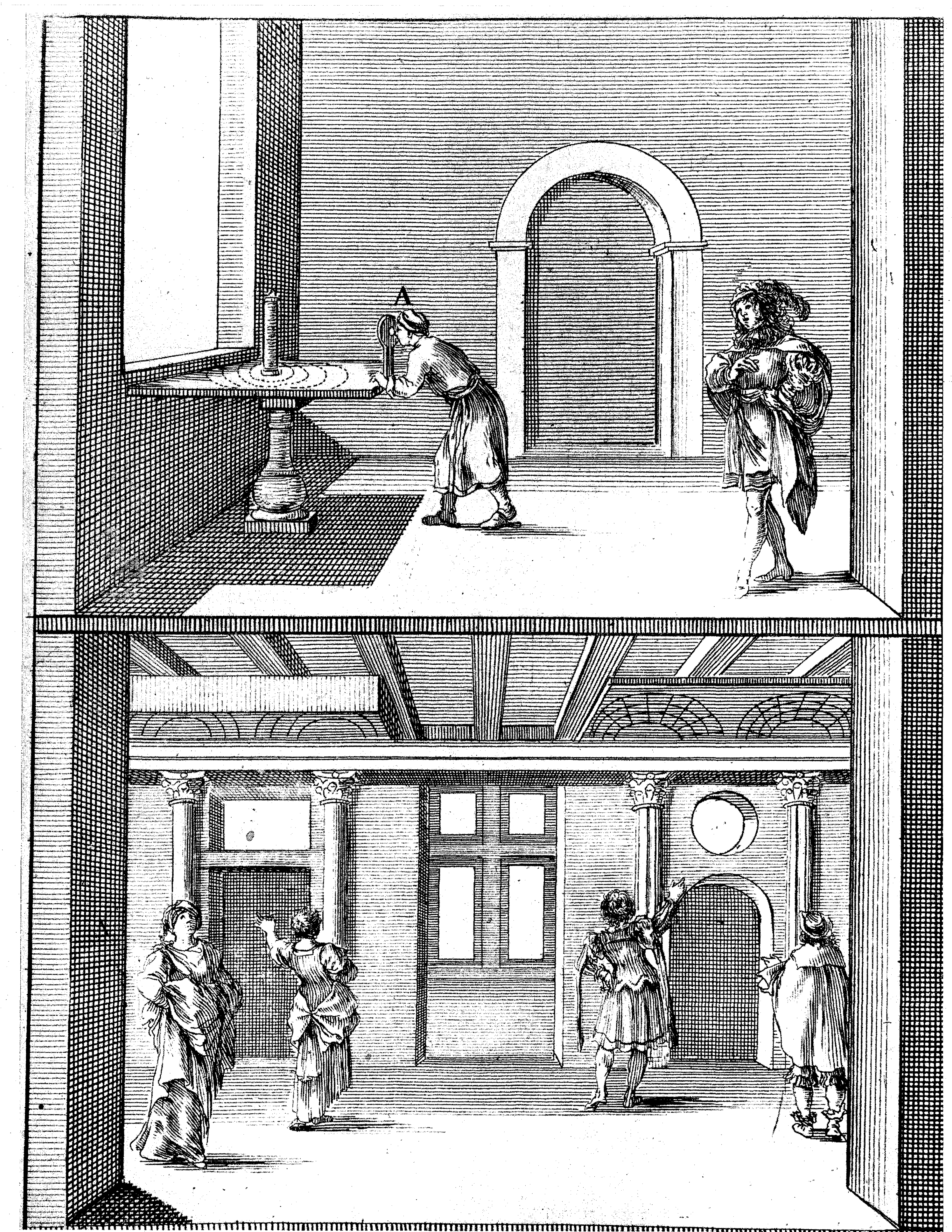

A

FIG. 119 Fr. Du Breuil: catoptric anamorphoses, 1649

see people fascinated by mirrors which compose the pillars of a colonnade or are fixed on a table (fig. 119).

Such compositions on the grand scale allow a multiplication of elements. Since the place of reflection is modified according to the spectator's viewing-point, several images can be depicted round the same cylinder. Frameworks which fit together, each of which contains an independent representation, project different figures in succession as the spectator advances. 'And in this way one can make 6, 7, 8 different portraits which to the person who gradually approaches will appear to rise in the mirror one after the other and disappear out of the top.' The man who expects to see himself in the polished surface finds himself confronting a procession of strange faces. Niceron even gives the address of a craftsman who specialized in these installations: 'Monsieur Seigneur in the Faubourg St. Germain to whom I have supplied models and whom I consider one of the best workmen we have at present in Paris for the making of these metal mirrors of every kind.' Such mirrors do not yet seem to have been generally available.

In combining his settings in a spirit of prestidigitation and of theatricality, Niceron was deeply conscious of the poetic side of optical mechanisms. In point of fact *Curious Perspective* was for him nothing more nor less than the *Artificial magic of marvellous effects*, as announced in his subtitle. An enchanted kingdom is superimposed on dry speculations.

Niceron's work is a synthesis of all previous researches. But the spread of catoptric anamorphoses was principally due to the Jesuits who doubtless also helped to perfect them. Up to the end of the seventeenth century, the principal new works on the subject by Bettini, Du Breuil, Kircher and Schott, bear the same stamp of origin.

Bettini's *Apiaria* (1642) had not caught up with the science of the time, since it continued to apply the methods of ordinary anamorphoses, including the projection by candlelight of a drawing perforated on pasteboard, directly onto the cylindrical mirror.[38] Instead of a violent enlargement on segments of circles, the result is just an extended drawing (fig. 80). The cone is presented by the side, not the apex, which is outside the field of reflection (fig. 120). The author had reached the stage of introducing a form of whose properties he was as yet unaware. But the German Jesuits – Kircher and his disciple Schott – in the *Ars magna* (1646) and the *Magia universalis* (1657) collected the main correct methods and were responsible for their distribution.

For the cylindrical anamorphoses, Kircher recopied Niceron's diagram, substituting the two-headed eagle for St. Francis of Paola, but he also advocated the archaic and totally ineffective candle method (fig. 121).[39] Gaspar Schott, while noting its impracticality, failed to realise its fundamental error: that it does not take into consideration the angles of incidence of a reflection.[40] To succeed, the operation must be carried out with a very thick piece of paper and in a darkroom. The geometrical methods continued to offer the most reliable solutions, so that to Hérigone's formula is now added that of Niceron–Kircher (fig. 121). Schott's *Magia universalis* is more complete than Kircher's *Ars magna*, but it repeats Bettini's errors concerning conical anamorphosis.

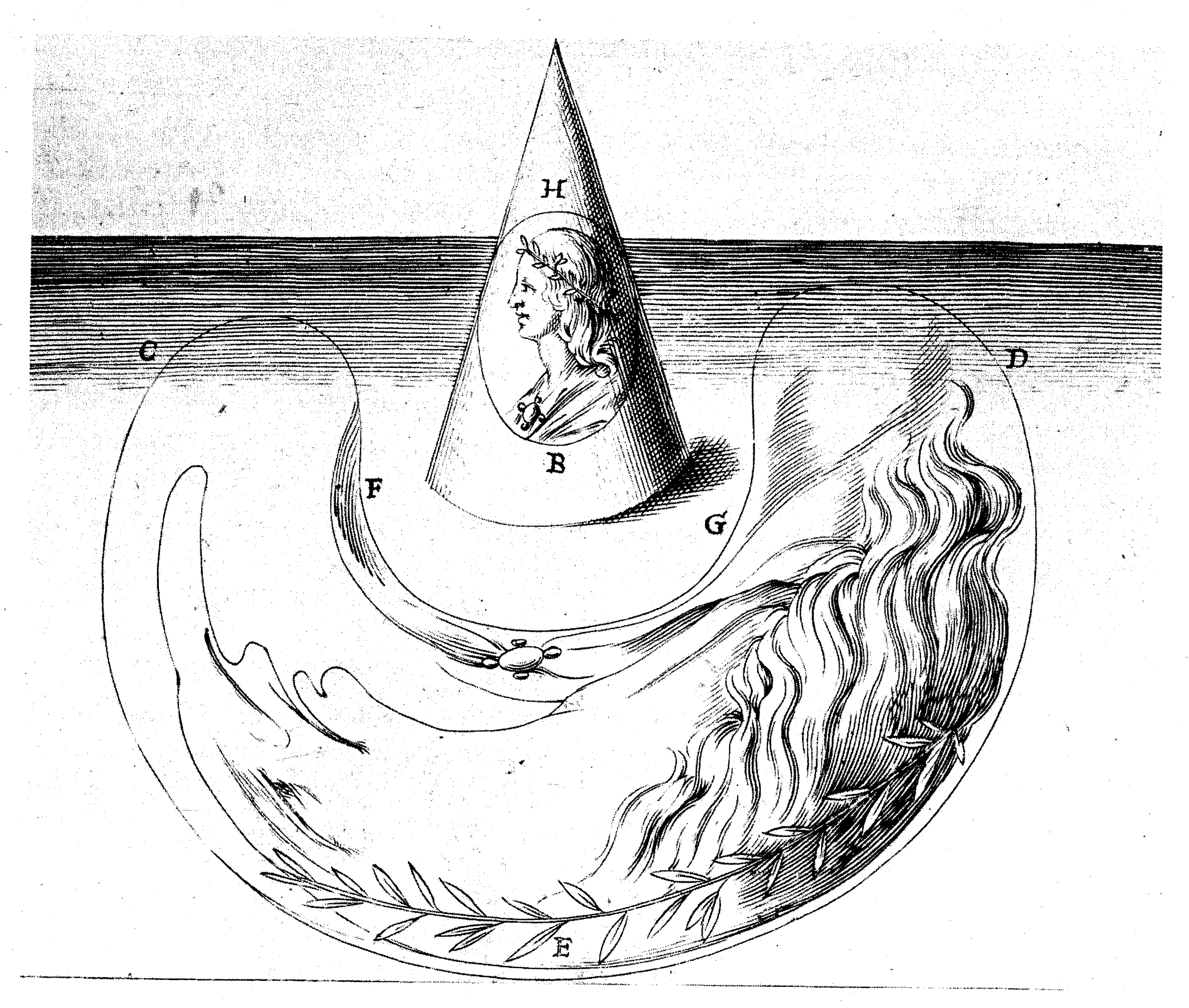


FIG. 120 Mario Bettini: conical anamorphosis, 1642

As with ordinary anamorphoses, so catoptric anamorphoses are integrated into the scholarly games which enliven the more popular manuals of mathematics and physics. We find them in Ozanam's *Recreations* (1694), in the treatises of J.-C. Sturm (1704) and C. Wolf (1715), in the *Elementary Lessons on Optics* of the Abbé de la Caille (1756).[41] Ferdinando Galli Bibiena recommends the use of the cone for

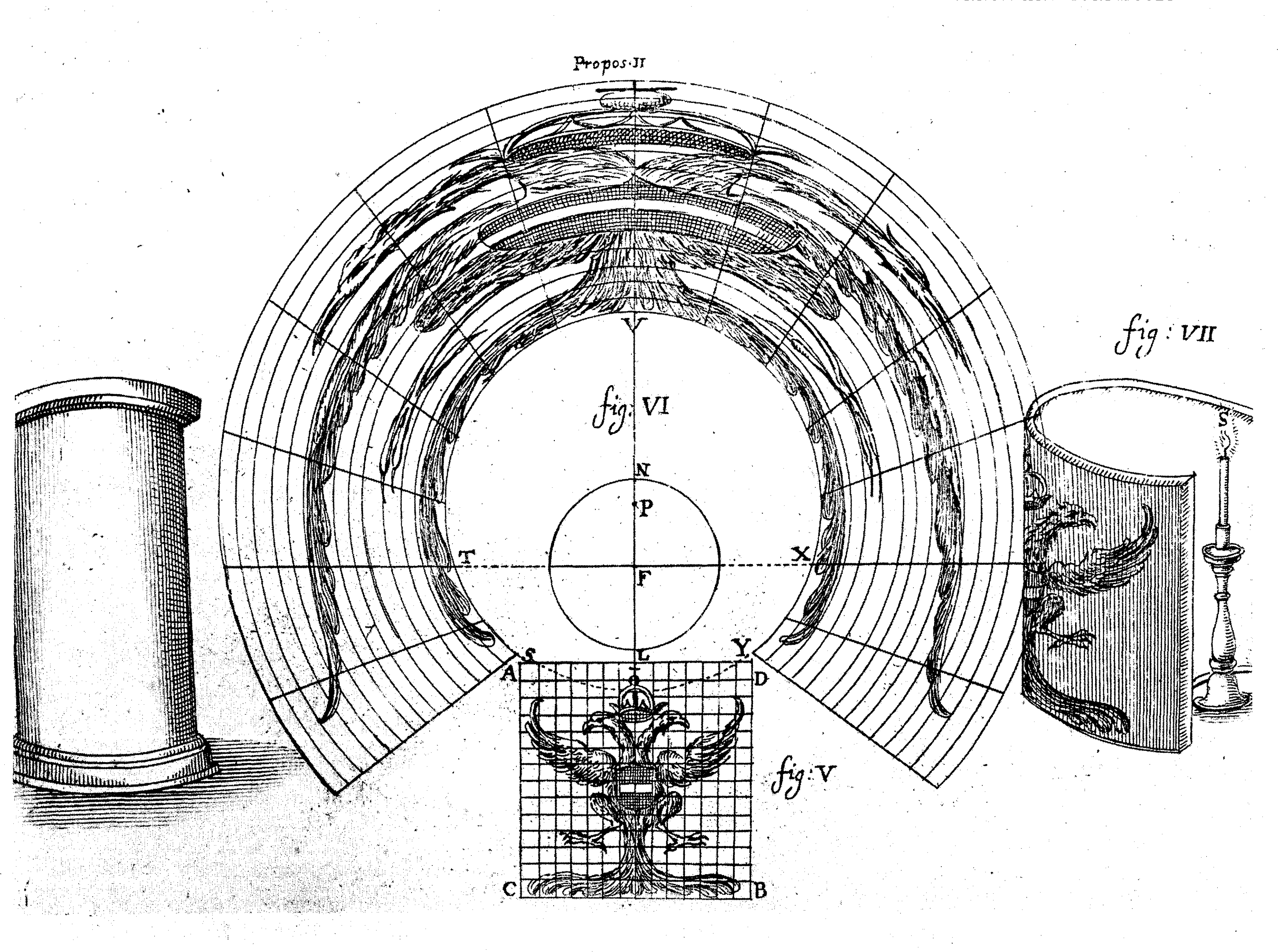
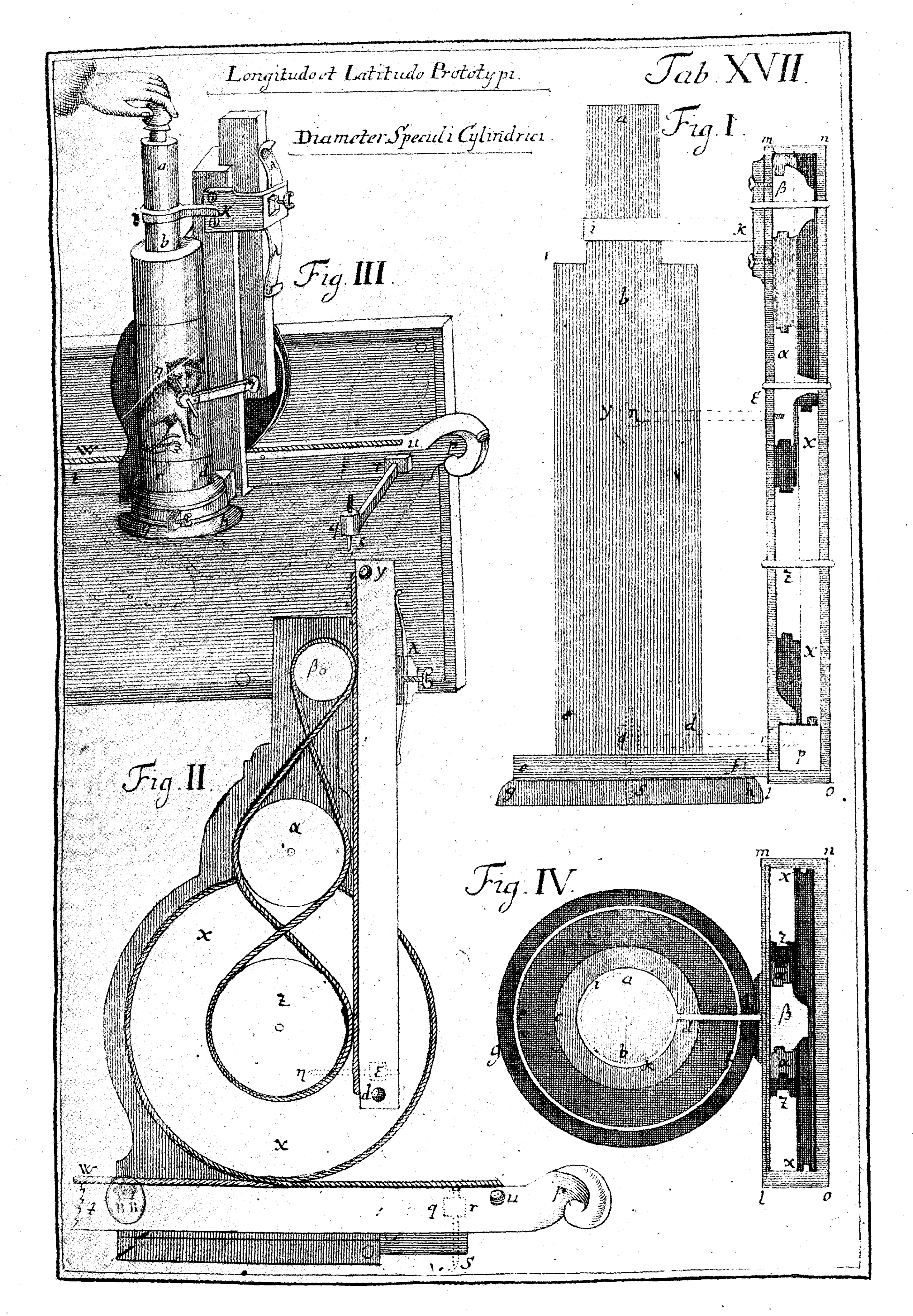


FIG. 121 Athanasius Kircher: cylindrical anamorphosis, 1646

his baroque décor.[42] Jacob Leupold, a member of the Berlin Academy and a specialist in the manufacturing and perfecting of scientific instruments, a subject on which he published seven important works, invented special machines for catoptric anamorphoses. They are devices with wheels of various dimensions, operated by means of cables which are lengthened in proportion to the degree of


Longitudo et Latitudo Prototypi.
Tab. XVII.
Diameter Speculi Cylindrici.
Fig. I
Fig. III
Fig. II
Fig. IV

anamorphic distortion required. There is one for the cylinder (fig. 122), another for the cone. The two machines were introduced in 1712 in the *Acta eruditorum*, published in Leipzig, and about the year 1715 became the subject of a small separate publication: *Anamorphosis mecanica nova*, which soon went out of print. They are next found in a posthumous miscellany published in 1739.[43]

FIG. 122 Jacob Leupold: anamorphic machine for a cylindrical mirror, 1712

Leibnitz took an interest in these optical diversions as both mathematician and philosopher and refers to them in one of his essays: 'When one says that this picture should show a portrait, one is correct in claiming that it is confused, since one is unable to say whether it is of a man, a monkey or a fish. However, when one looks at it in a cylindrical mirror the confusion disappears and one sees that it is Julius Caesar.'[44]

We are reaching the period of widest dissemination. Anamorphoses, which had been shown previously in scientific circles, collections of curiosities, *Wunderkammern* or in the houses of the great as private masterpieces now became popular toys but without losing any of their magical fascination. They could be found throughout Europe and were available at every price.

But, in the meantime, the Jesuits had carried them as far as China. In his description of various installations in the monastery of Peking, where there were automata, astronomical instruments, a camera obscura and magic lanterns, Fr. J.-B. du Halde (1735) also mentions several anamorphoses.[45] The passage deserves to be quoted in full:

> Fr. Grimaldi gave another display of the wonders of Optics in the garden of the Jesuits of Peking which greatly astonished all the grandees of the Empire. He drew on the four walls four human figures, each one the length of the wall which was fifty feet. Since he had perfectly observed the laws of Optics, we could see facing us only mountains, forests, the hunt and other things of a like nature. But from a certain viewing-point we could see the representation of a well-built, well proportioned man.
>
> The Emperor honoured the House of the Jesuits with his presence and looked admiringly at these figures for a long time. The great men and the chief Mandarins who crowded in showed the same wonderment. But what struck them even more was to see such regular and exact figures on very irregular walls and interrupted by several doors and windows.
>
> It would take too long to report all the figures drawn confusedly but which could be seen clearly from a certain point or which were corrected by means of conical, cylindrical, pyramidal mirrors and other miracles of Optics which Father Grimaldi presented before the finest intellects of China and which equally attracted their surprise and admiration.

Among these devices was 'a tube with a polygonal glass which with its different facets collected several parts of different objects into a single image; so that, instead of a landscape, woods, flocks and a hundred other things represented in the Picture, one could distinctly see a human face, a man and some other very clearly depicted figure.' We recognize in this the dioptric apparatus, the mechanics of which Niceron had learned at Lyons in 1635. With its array of scientific instruments of every sort, the house and garden of the Peking Mission reminds us of Sébastien Leclerc's engraving *The Academy of Arts and Sciences* (fig. 78).

The description of the tube with a polygonal glass is from a translation of the Latin text of Ferdinand Verbiest (1687), a Belgian Jesuit who inherited from Adam Schall the presidency of the Tribunal of Astronomy and Mathematics.[46] The deviser of these anamorphoses, Fr. Grimaldi, a man of Piedmontese origin, went to China in 1669, took part in a mission to Peter the Great in Moscow in 1686 which he prolonged by a stay in the West, and died in Peking in 1712.[47] He was a celebrated scholar and had close associations with Leibnitz.[48]

How strange was this spread of anamorphic perspective to a monastery at the other end of the world! The instruments installed by the Peking Jesuits between 1669 and 1685 were direct descendants of the optical devices of the Minim Friars of Paris and Rome, and had close links with the vast murals painted in their cloisters. Fr. Grimaldi was Niceron's successor.

The presence of these unusual installations in a missionary centre in the midst of a foreign people was due to the fact that the best approach to the Emperor K'ang-hi (1654–1722) and his subjects was through astronomy and mathematics.

'The Jesuits, seeing how necessary the protection of this great Prince was for the spread of the Gospel', writes Fr. du Halde, 'never missed any opportunity of arousing his curiosity and satisfying his natural taste for the Sciences. They began by imparting to him knowledge of optics.'

Thus, those selected for the Chinese mission were predominantly scholars, astronomers, physicists and mathematicians. Peking became an important scientific centre provided with a *Wunderkammer*. Doubtless the experiments and demonstrations which took place there were conducted in the spirit of intellectual conquest and within the framework of a civilizing mission. As treated by the Jesuits, anamorphosis became in some way an instrument for conversion to Christianity. But there was another aspect to it – the nostalgia of men lost in a distant country finding solace in the pursuit of familiar studies. Meetings and encounters came about that were, to say the least, unexpected. The truth was that China had its own tradition of mirror anamorphoses.

CHAPTER TEN
Chinese prestidigitation

The uniformity of certain examples of Chinese anamorphoses known to us suggests mass production (figs. 123–7).[1] We see pairs of lovers, erotic themes, a woman concealed in a spongy rock, an elephant bearing a man, horsemen, and a warrior with a sabre in each hand.

As in the Western world, the dimensions and siting of the mirror are indicated by a circle. The circle is sometimes exchanged for a sphere placed in front of these expanded figures, thus making them even more enigmatic.

These are cylindrical anamorphoses, but they have been drawn directly, without the help of the linear framework which is normally so clearly marked on the circumference and the hub of the composition: they are produced neither by means of a grid nor by calculated transposition by lines bounded by a square inscribed in the segment of a circle but by sheer virtuosity of draughtsmanship. No doubt the artist drew while looking in a mirror, with the picture to be reproduced at his side. The figure emerged in its own image as the work proceeded. The ability to draw directly from life and a gift for contrivance have always been characteristics of artists of the Far East. Their method provides more subtle results in that the subject is never completely distorted thus corresponding to the first stage in the development of anamorphoses in the West. The presence of identical pictures (the pair of lovers, the woman in the rock) in different collections confirms the systematic return to pre-established models.

Could these astonishing anamorphic representations be the Chinese reply to Grimaldi's catoptrics and his band of opticians and mechanics? *A priori*, the texts of Frs. Verbiest and du Halde would leave us in no doubt on the matter, were it not that they also mentioned hydraulic and pneumatic machines which, with automata, had long been the special pride of China. These machines included chariots and boats mounted on wheels. Semedo, a Portuguese Jesuit, had in fact seen examples of these in Peking in about 1630, notably in funeral processions which he describes: 'Machines which are huge effigies of men and horses, elephants, lions, tigers, go in front . . . followed by other Machines, namely triumphal chariots, pyramids and other similar things. . . . These Machines are accompanied by a vast multitude of people.'[2] The Chinese, it would seem, had nothing to learn from the West.

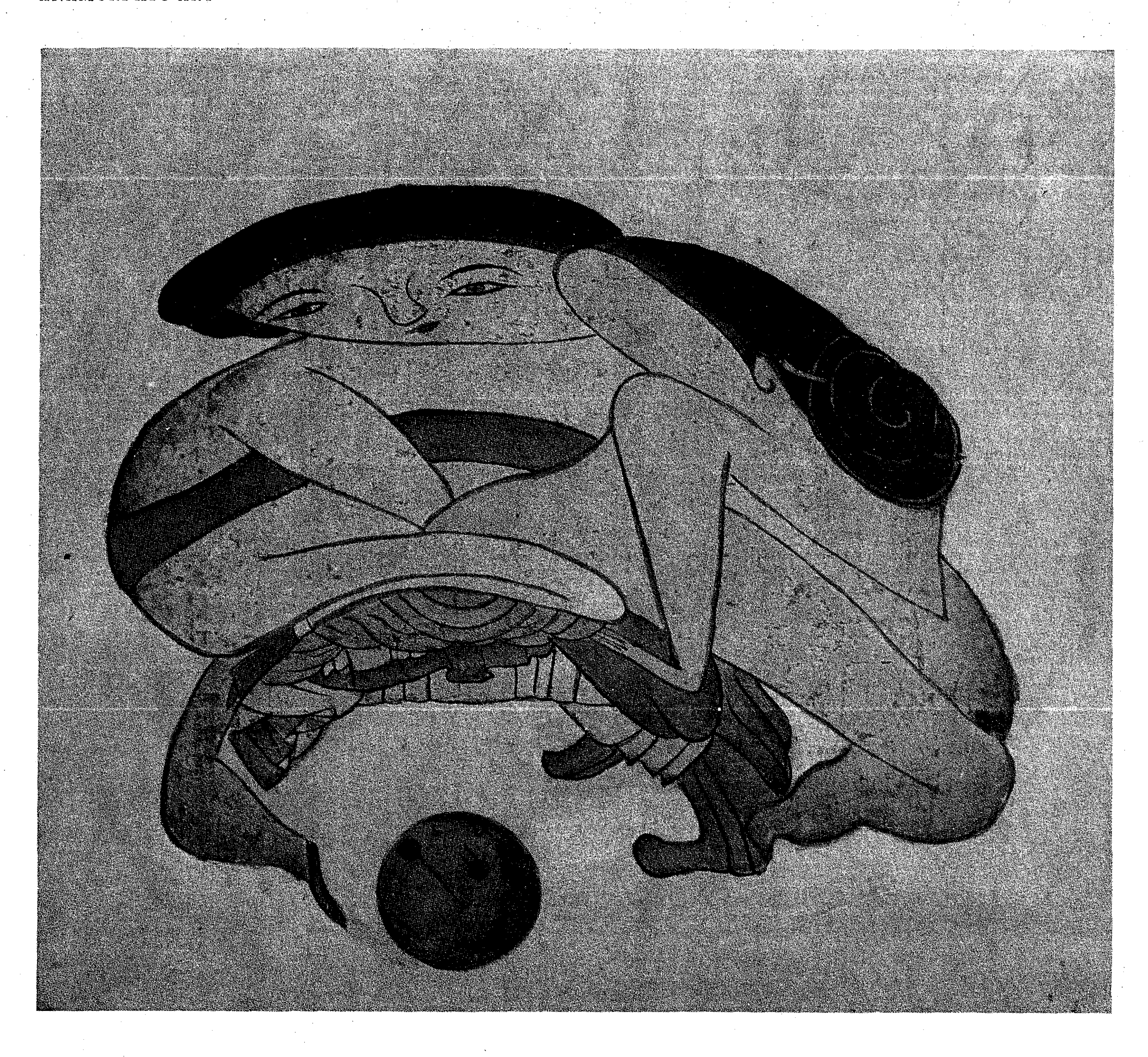


FIG. 123 Chinese anamorphosis: *A Pair of lovers*, painting on paper, Wan-li period (1573–1619). N. Manoukian Collection

In the matter of painting we know how hostile the Chinese were to the European contribution. The lessons on perspective given by Fr. Buglio who went to China in 1639 with three pictures which he presented to the Emperor, never got beyond the stage of theory. An attempt at the application of the laws of perspective in a classical work on weaving and agriculture by Chiao Ping-chên (1696), who worked with the Jesuits at the Tribunal of Astronomy likewise bore no fruit.[3] Finally, Wu-li, who went to Rome in 1681, learned nothing applicable to this kind of art. The whole system of linear perspective was alien to Far Eastern vision. Western

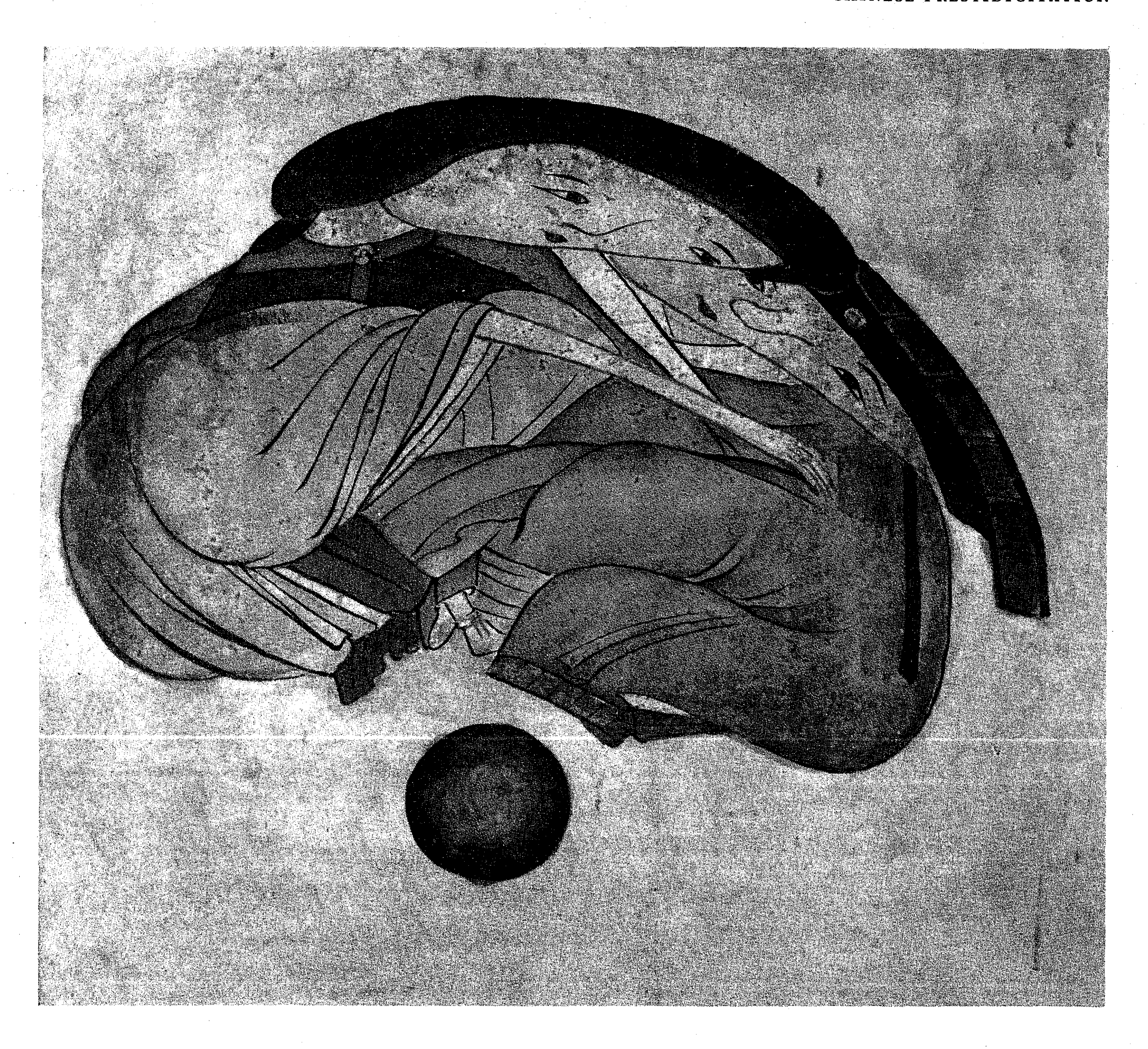


FIG. 124 Chinese anamorphosis: *A Pair of lovers*, painting on paper, Wan-li period (1573–1619). N. Manoukian Collection

features in Chinese art at this period were confined to Christian themes or to pictures of Europeans, in which they took on an exotic accent.[4]

The Chinese anamorphoses which have come down to us have nothing in common with these groups and we find no hint of Jesuit inspiration in their subject matter. As for the catoptric mechanism, mirrors had always had a legendary power in China and they served a variety of purposes. There were all kinds, endowed with every conceivable property. There were prophetic mirrors, talking mirrors, mirrors that made birds dance and sing, mirrors that rendered visible the

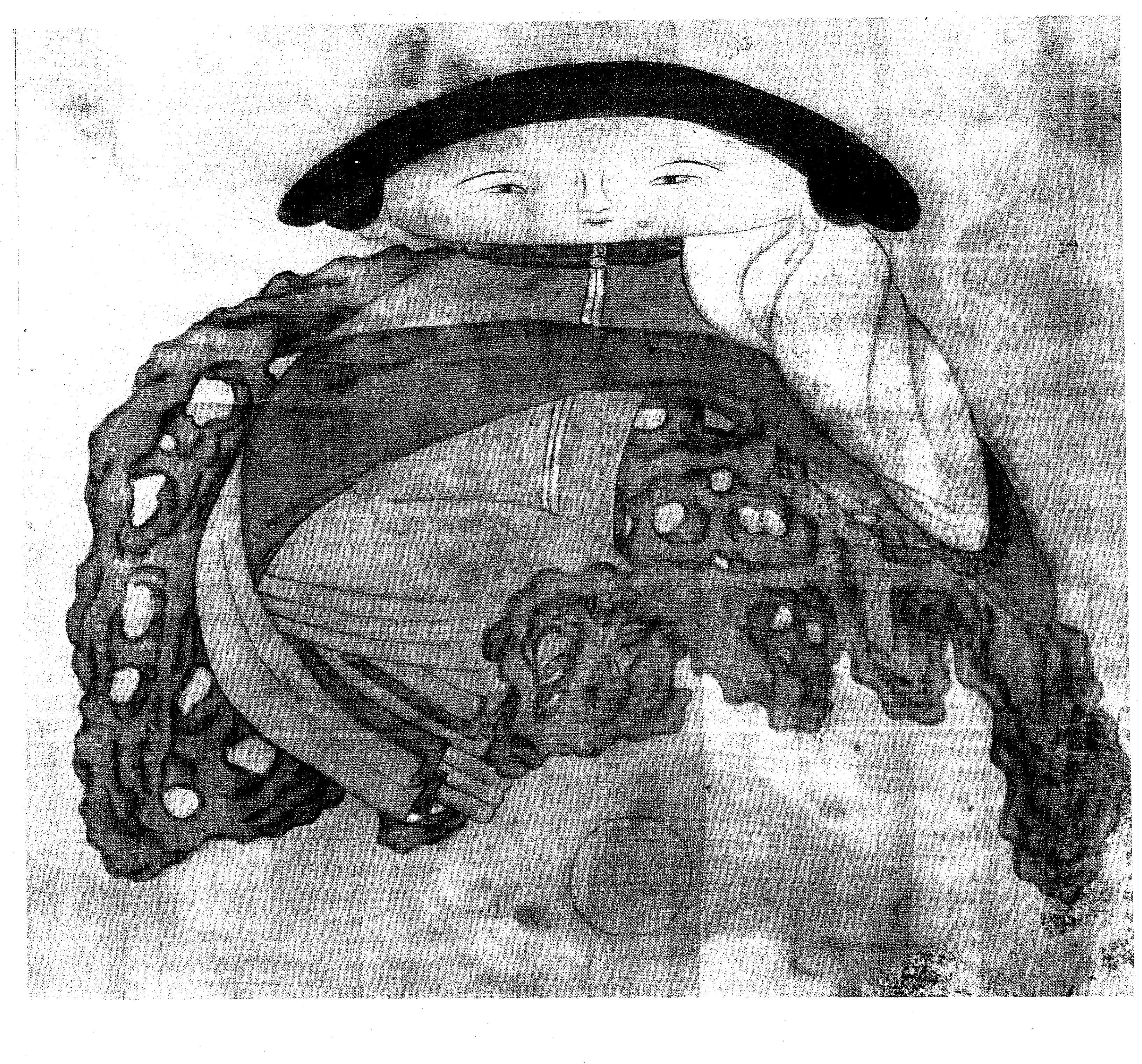


FIG. 125 Chinese anamorphosis: *Woman in a spongy rock*, painting on silk, Wan-li period (1573–1619). Former G. Salles Collection

invisible forms of spirits. The pure fire of the sun was ensnared by round mirrors, the pure water of the moon by square mirrors. At night men protected themselves against the forces of evil with the help of spherical mirrors which they hung above their heads.[5] During excavations in Chinese Turkestan, a mirror was discovered which produces a sound when shaken, while 'magic mirrors', which are equally well known to us, project onto a screen figures that are carved on the reverse side. Texts referring to them date from the middle of the ninth century and an explanation of the 'mirror which allows light to penetrate' through the design made in a more highly polished copper, was provided by Wu-ch'iu yen (died 1311).[6] It has

since been discovered that the secret lies in the structure of the concave reflecting surface in which flat portions correspond to the decoration on the back.[7] There also existed in Japan a mirror which, looked at obliquely, presented the image of a Buddhist god. The design (anamorphic ?) would have been executed with paste which could not be seen from the front but only from an oblique angle, even after the metal had been polished.[8] Infinitely diverse, enigmatic, the source of legends, these mirrors which could make visible the invisible far outdo the four basic types of the West. We may well ask ourselves therefore whether the Emperor and the mandarins were really surprised when they saw Grimaldi's catoptric anamorphoses. As far as moving machines are concerned, the Oriental interest seems to have been limited to technical details.

As in the case of the automata, it was the missionaries who seem to have been the first people to be struck by the abundance and quality of mirrors in the country. 'Mirrors are highly esteemed in China' reports Fr. Jarric in his account of a journey to Peking in 1600.[9] On his return from the Far East in 1665, Fr. Grueber relates that 'Chinese mirrors are all of good material, and, as they are extremely expert in the art of casting metals, they make very fine concave mirrors which can be bought cheaply.'[10] Mirrors are even mentioned in connection with conjuring. In an account by Dutch emissaries sent to Peking in 1655 there is a description of some of these popular spectacles:

> China is full of jugglers and of players of farces. Some amuse the audience with rats or mice which they cause to dance to the sound of musical scales . . . others do conjuring tricks, put a thread in the corner of someone's eye and extract it from his nose, cause spectators to appear with asses' heads, show blades of straw changed into dragons and a thousand other tricks and buffooneries which would be considered by many people as sorcery . . . And, in truth, the most intelligent onlookers are astounded when they see actions which seem to pass beyond the bounds of natural powers since the causes of them remain secret to all except Physicists.

The author then explains some of these tricks, and concludes:

> This is how it happens that the majority of the tricks of the conjurors and operations of natural Magic are deemed to be pieces of sorcery by those who do not penetrate the mysteries. If you consider here all those tricks done by means of these artifices, including those managed by the use of mirrors and other optical inventions, you will be less astonished by the large number of Magicians whom the common folk believe to exist in the world.[11]

No anamorphic contrivance is specified in this general description of 'artifices by the use of mirrors', nor are there any accounts of any other optical subterfuges employed in these diversions. It would, however, be surprising if Chinese conjurors did not have recourse to these known practices which would have been so perfectly suited to the nature of their spectacles.

Did the Chinese element play any part in the development of catoptric anamorphoses in Europe? What form did any such influence take? There are three elements in the problem:

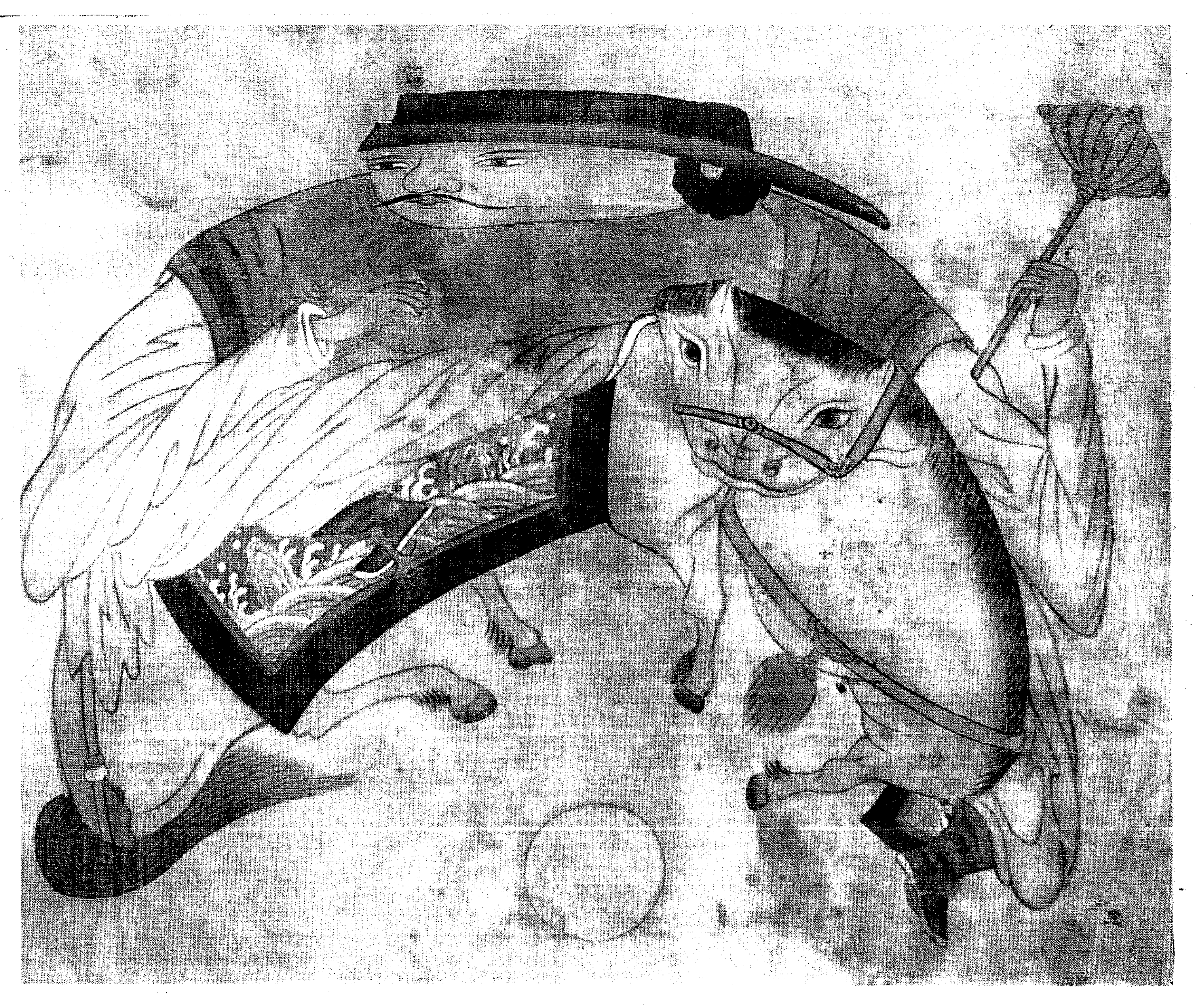


FIG. 126 Chinese anamorphosis: *Horseman*, painting on silk, Wan-li period (1573–1619). Former G. Salles Collection

I More than a century had to pass before direct anamorphosis was supplemented in the West by catoptric anamorphosis, and this development occurred during a period when relations with China were renewed through the missionaries and scholars who were particularly interested in optics.

II Catoptric anamorphosis was not the result of the extension and transformation of geometrical perspective systems with all their refinements in the field of reflection, but came into being independently and in an archaic form.

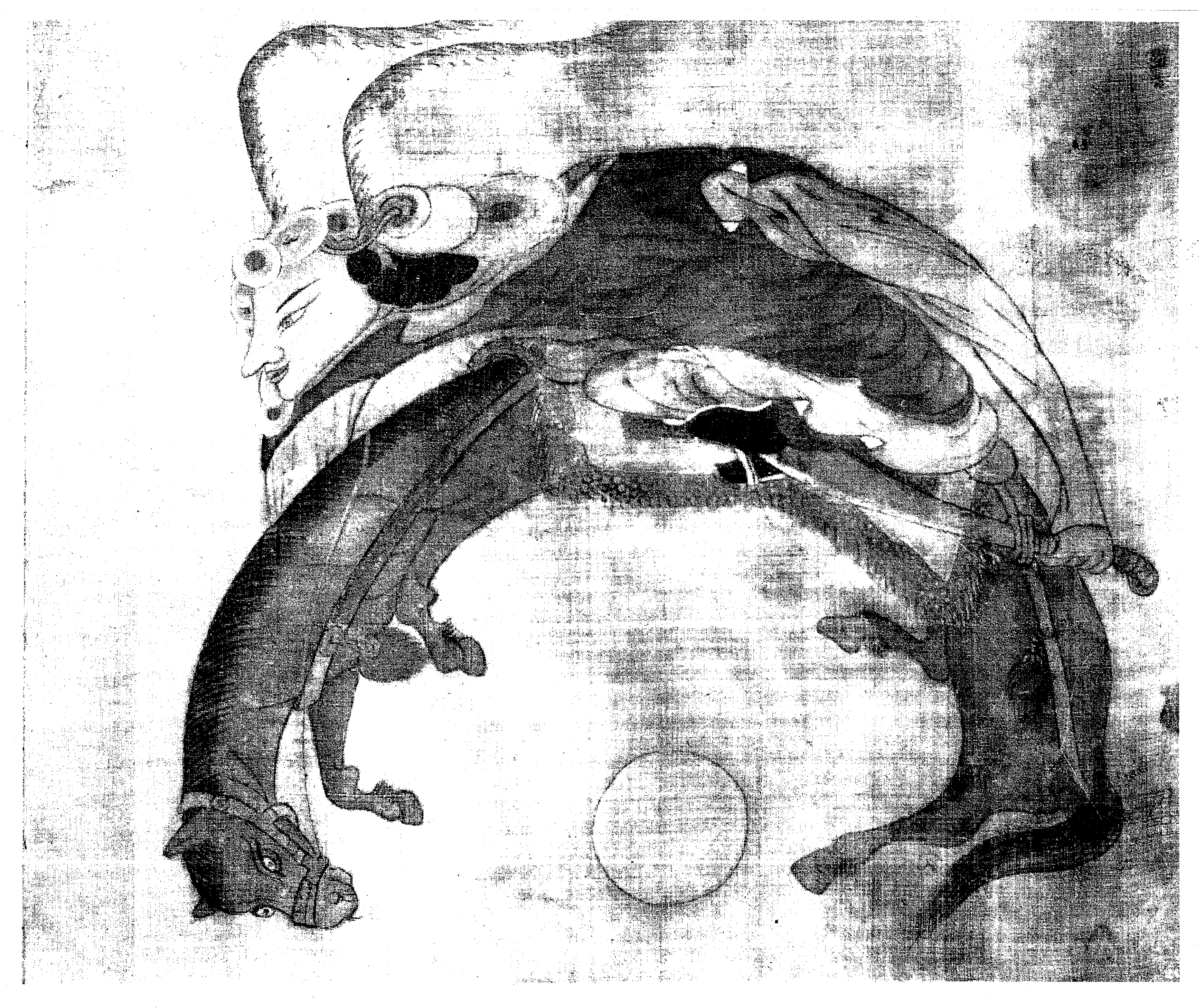


FIG. 127 Chinese anamorphosis: *Mounted warrior*, painting on silk, Wan-li period (1573–1619). Former G. Salles Collection

III One of the earliest known cylindrical anamorphoses represents an elephant, the most characteristic symbol of Asia.

Should we then conclude that catoptric anamorphoses are an Oriental feature grafted – after a lapse of time – onto Western structures, remodelled to incorporate these elements? Strange as it may appear, stylistic and historical evidence agrees on this point. All the examples of Chinese anamorphoses we possess go back to the Ming dynasty (1368–1644). The armour of the warrior with sabres whom we see

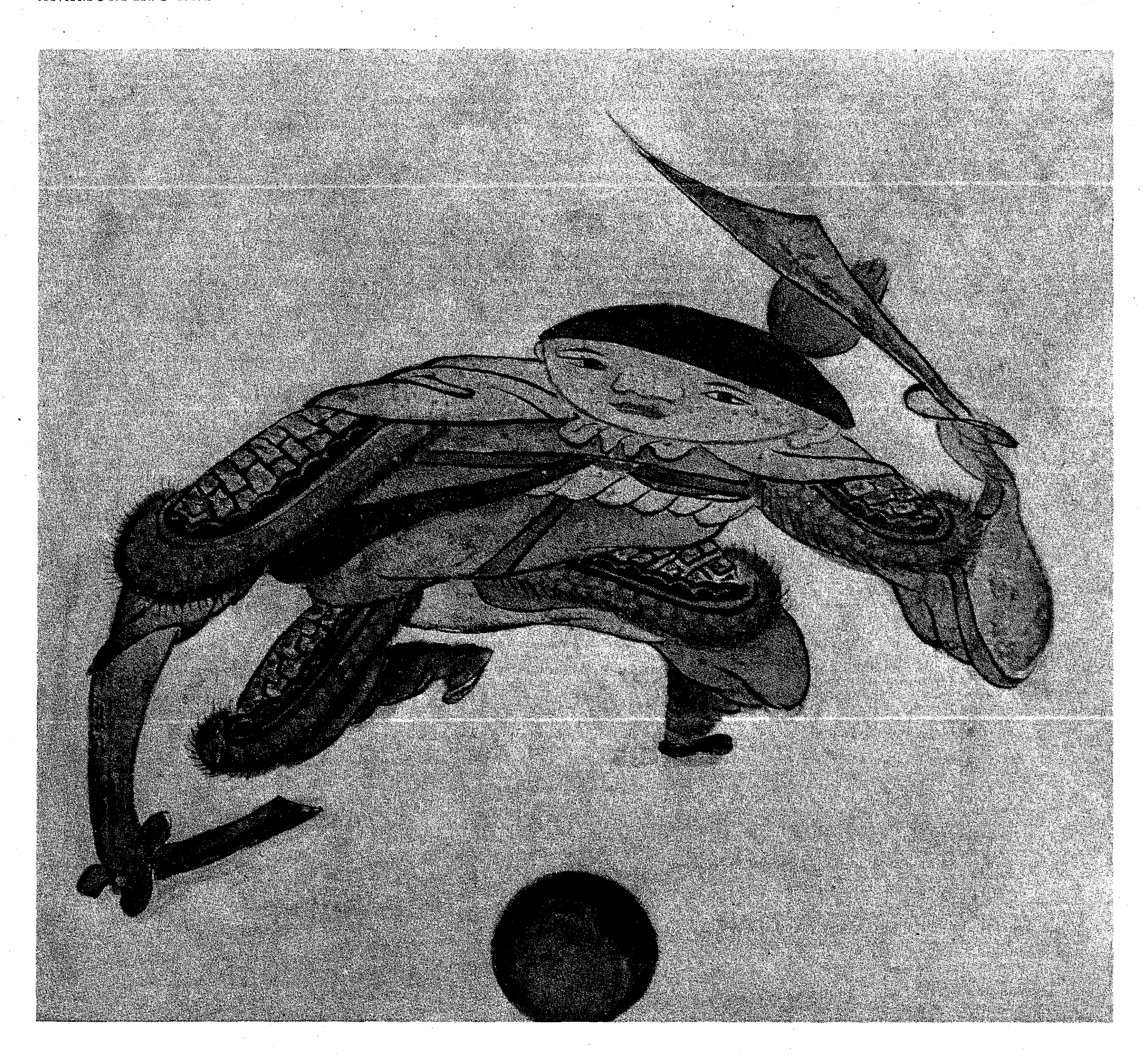


FIG. 128 Chinese anamorphosis: *Warrior with a sabre in each hand,* painting on paper, Wan-li period (1573–1619). N. Manoukian Collection

on one of the compositions certainly belongs to that period (fig. 128). The shoulder-plates, composed of metal scales trimmed with fur reaching to the elbows, the overlapping plates of a similar type which protect the front of the thighs, and, finally, the cloth knotted round the neck and covering the shoulders are like the accoutrements of statuettes of warriors of the period from 1500 to the early seventeenth century.[12] In the majority of these examples, the warrior represented is Kuan Yü, the military hero of the Three Kingdoms, canonized in the twelfth century, who in 1594 became the God of War under the title Kuan-ti. A Chinese porcelain of the sixteenth century shows him dressed in a fashion closely resembling that of the

anamorphic figure.[13] Every item including the sash stretched diagonally across his chest, is found in the porcelain. Furthermore, the licentious couples derive directly from an erotic cycle which arose in China within the precise limits of the reigns of Lung-ch'ing (1567–72) and Wan-li (1573–1619) and came to an abrupt end with the establishment of the T'sing dynasty in 1644 (figs. 123 and 124).[14] The bound-up feet of the women and the garments, the *mo-hsiung*, covering their breasts, are identical. The woman in the sponge-like rock also appears in one of these illustrations. The imagery of the period had a secret version, the treatment and details of which correspond exactly.[15] A date when these anamorphoses were not only in favour in China, but were also disseminated far beyond her frontiers, can be established with great exactness.

By an odd combination of circumstances it is in the West that we find precise details of this. The elephant in the anamorphosis by Simon Vouet (fig. 111), with its harness and its saddle-cloth, its position in front of a mirror, closely resembles one of the Chinese anamorphoses shown here (fig. 129). Simon Vouet's elephant was, it will be recalled, engraved in Rome about 1625 but the theme comes from elsewhere and is much older. Vouet went to Italy not from Paris but from Constantinople, where he had gone in 1611 in the retinue of Charles Harlay de Sancy, ambassador to the Sublime Porte. He stayed in that city, open to the great markets of the Near and Far East, for about a year and then left for Venice. According to tradition, the artist had an audience with Ahmed I of whom he is even said to have made a portrait.[16] The palace had a special pavilion for Chinese collections, built under Suleiman I the Magnificent (reigned 1520–66) by the architect Sinan, and reconstructed after a fire in 1574.[17] Vouet had many opportunities to see these 'surprise' arrangements and he managed to make sketches and even to obtain specimens of them.[18] The cylindrical anamorphosis of 1625, set in a Roman garden, (fig. 111) is Ming. It is possible that the figure delineated on the table surface was directly reproduced from an authentic piece he had brought back, but this does not apply to its reflection in the cylinder (fig. 111). This reflection appears in fact in a panel cut off at the top by a horizontal line which normally breaks up into three elliptical curves each corresponding to one side of the picture. The image was intended to rise up as on a stage, topped by a garlanded curtain, and not in a rectangular show-case. It would seem then that the cylindrical mirrors which would have enabled the artist to reproduce both the anamorphosis and its reflection in an exact manner were not yet available in Rome.

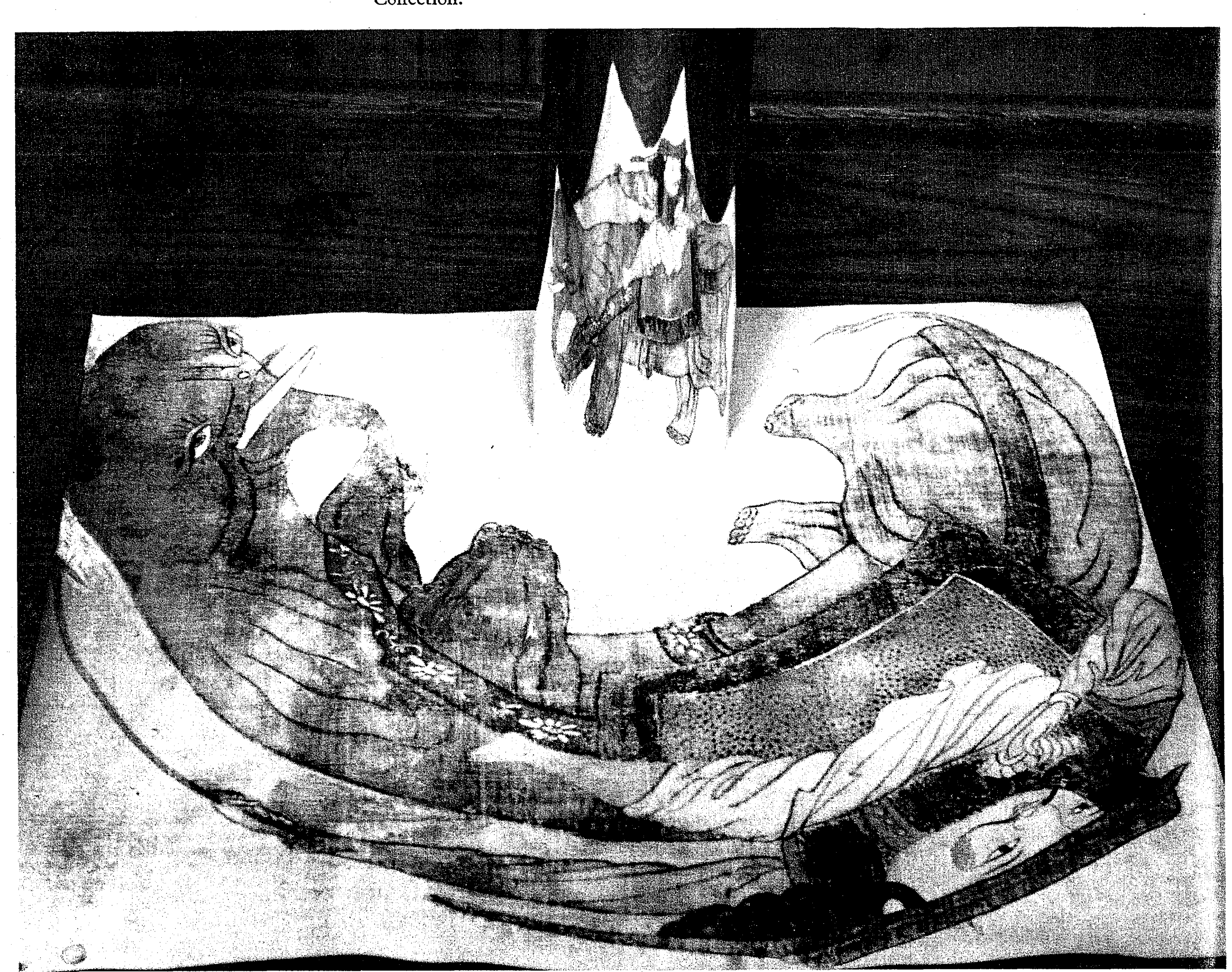
Madeleine de Scudéry's description of another palace in Constantinople, that of Ibrahim Bassa, the hero of her novel (1641), is not without interest in this connection.[19] In this building, we read, are amassed 'all the rarities and riches that Persia, China and Japan can offer'. There were globes, maps, mathematical instruments, astrolabes. 'But, as Ibrahim was not satisfied with these necessities and wanted attractive things still more, there were a number of those paintings which for optical reasons make such charming and beautiful illusions. For this purpose he had Cylinders of various sizes.'

This account is doubtless romanticized but it contains precise details and we are justified in wondering about the sources of the description of an oriental dwelling

filled with catoptric anamorphoses. Having settled in Paris in 1627, where Madeleine de Scudéry arrived three years later, Simon Vouet was among those who could have provided picturesque details about Turkey to an author collecting documentation for the local colour of her novel. Furthermore, no-one could have appreciated the exotic refinement of these objects better than Vouet.

Whatever the explanation, the depiction of the elephant in the mirror is of prime importance in the story of the transmission of these objects from China to the Bosphorus and from the Bosphorus to the whole of Europe. Executed in Italy by a German, after a picture by a Frenchman connected with a group of scholars preoccupied with the problems of anamorphosis, the oldest picture we have of a mirror cylinder marks the intersection of roads that lead towards the centres of its greatest propagation – centres which were also fed by more direct contributions.

FIG. 129 Chinese anamorphosis: *Personage mounted on an elephant*, painting on silk, Wan-li period (1513–1619). Former G. Salles Collection.



Introduced on favourable soil and at the time when these optical diversions were increasingly popular, mirror anamorphosis spread in the West like wildfire and became so completely integrated with Western systems that there could be no question of foreign origin. As a more reliable and spectacular method, it finally eclipsed direct perspective systems, which declined during the eighteenth century to such an extent that Horace Walpole himself was confused about the two different techniques.

It was about 1675–80 that these perfected forms, mounted on complex frameworks, based on all the rules governing reflection, were put on display in the scientific monastery of Peking. For the methods of installing them, the Jesuits of the Mission probably went back to the work of their colleagues Du Breuil, Kircher or Schott, little suspecting that these were the *chinoiseries* that had fascinated their precursors more than half a century before. The Chinese present at Grimaldi's demonstration must have regarded it with a hostile eye, since they would have been comparing its mathematical integrity with the tricks and subtleties of their own prestidigitation and trying to assess the difference in the respective results.

But these variations of approach matter little. Whatever the means used for producing catoptric anamorphoses, we see them disseminated and repeated everywhere. In China, where the supernatural and reality merged, and in Europe, where science at that time was revealed as a marvel, these mechanical surprises corresponded to the appetite for the strange, the astonishing, the impossible. They were mechanical toys that delighted and diverted men and set them meditating on the laws of nature and the artifices which could dominate them. Brutally disrupting and distorting life in order to integrate it into the world of illusion, they also, paradoxically, demonstrated the power of Art and revealed its quintessential magic.

Notes to the text

PREFACE

1. From the Greek *ana* – 'back', indicating return towards and *morphe* – 'form'. I do not know of any use of the word 'anamorphosis' before Gaspar Schott (1657).
2. Frances de Dalmatie, *Anamorphose* (Paris, 1957), pp. 9 and 11.
3. Jean Cocteau, 'Notes autour d'une anamorphose, un phénomène de réflexion', in *Le Monde et la Vie*, No. 95 (April 1961), pp. 35ff.

CHAPTER ONE: ACCELERATED OR DECELERATED PERSPECTIVE

1. Plato, *Oeuvres*, trs. V. Cousin (Paris, 1837), vol. II, *Le Sophiste ou de l'Etre*, pp. 219–20.
2. See Vitruvius, *Les Dix Livres d'Architecture, corrigés et traduits nouvellement par Cl. Perrault* (Paris, 1673), pp. 193–4, 77–8, 84, 93.
3. This question of the *scamilli impares* had already been dealt with by Bernardino Baldi: *Scamilli impares vitruviani* (Augsburg, 1612). Perrault is wrong in seeing them as a series of projections. See E. Burnouf, 'Explications des courbes dans les édifices grecs, Note additionnelle relative d'un texte vitruvien', *Revue générale de l'architecture*, II (1875), pp. 146–54.
   Scamillus, a diminutive of *scamnum* (lat.) 'a step', in the present case *scamilli impares* (lit. 'unequal projections'). *Translator's note.*
4. For linear perspective of this period, see J.-H. Luce, 'Géométrie de la perspective à l'époque de Vitruve', *Revue d'histoire des sciences et de leurs applications* (1953), pp. 308–21.
5. Alberti mentions a dispute concerning these visual rays: for Plato as for Euclid they emerge from the eye; for Democritus and Empedocles, they emanate from the object.
6. *La Perspective d'Euclide, traduite par R. F. de Chantelou* (Le Mans, 1663), pp. 2, 97 and 100.
7. M. S. Bunim, *Space in Medieval Painting and the Forerunner of Perspective* (New York, 1940); G. F. Vescovini, *Studi sulla prospettiva medievale* (Turin, 1965).
8. G. Mancini, *Vita di L.-B. Alberti* (Florence, 1911). Leon-Battista Alberti, *Della pittura*, ed. L. Mallé (Florence, 1950); P.-H. Michel, *La Pensée de L.-B. Alberti* (Paris, 1930); J. Spencer, *L.-B. Alberti: On Painting* (London, 1956); S. Y. Edgerton, Jr, 'Alberti's Perspective: A New Discovery and a New Evaluation', *The Art Bulletin*, XLVIII (1966), pp. 367–78; G. Ten Doesschate, *De Derde commentaar van Lorenzo Ghiberti in verband met de mildeleeuwsche Optick* (Utrecht, 1940); R. Krautheimer, *Lorenzo Ghiberti* (Princeton, 1956), pp. 234ff; A. Parronchi, 'Le misura dell'occhio secondo il Ghiberti', *Paragone*, 123 (1961). See also G. S. Agran, 'The Architecture of Brunelleschi and the Origin of the Perspective Theory in the Fifteenth Century', *Journal of the Warburg and Courtauld Institutes*, IX (1940), pp. 96–121; A. Parronchi, 'Le due tavole prospettiche del Brunelleschi', *Paragone*, 107 (1958), pp. 3–32.
9. N. G. Poudra, *Histoire de la Perspective ancienne et moderne* (Paris, 1864); E. Panofsky, 'Die Perspektive als symbolische Form', *Vorträge der Bibliothek Warburg* (1924–5), pp. 258–330, and 'Codex Huygens and Leonardo da Vinci's Art Theory', *Studies of the Warburg Institute*, XIII (1940); G. A. Richter, 'Perspective Ancient, Medieval and Renaissance', *Scritti in onore di Bartholomeo Nogara* (Vatican City, 1937), pp. 381ff; W. H. Ivins, *On the Rationalization of Sight with the Examination of the Renaissance Texts on Perspective*, Metropolitan Museum of Art (New York, 1938), Paper 8; J. White, 'Development in Renaissance Perspective', *Journal of the Warburg*

Institute, VII (1949) and *The Birth and Rebirth of Pictural Space* (London, 1957); D. Gioseffi, *Perspectiva artificialis, Spigolatura e appunti*, I[n]stituto di storia dell'arte, No. 7, *Università degli studi* (Trieste, 1957); R. Klein, 'Etudes sur la perspective de la Renaissance', *Bibliothèque d'Humanisme et Renaissance*, 25 (Geneva, 1963); A. Parronchi, *Studi sulla 'dolce' prospettiva* (Milan, 1964).

10. F. Clerici, 'The Grand Illusion, Some Considerations of Perspective, Illusionism and Trompe-l'oeil', *Art News Annual*, XXIII (1954), pp. 98ff.
11. *Ibid.*, p. 105 and fig. p. 128.
12. For the evolution of the stage, see H. Leclerc, *Les Origines italiennes de l'architecture du théâtre moderne* (Paris, 1946) and G. R. Kernodle, *From Art to Theatre, Form and Convention in the Renaissance* (Chicago, 1944); see also G. Schöne, *Die Entwicklung der Perspektivbühne bis Galli-Bibiena, nach den Perspektivbüchern* (Leipzig, 1933).
13. S. Serlio, *Il secondo Libro di Perspettiva* (Paris, 1545), p. 43, and D. Barbaro, *La pratica della perspettiva* (Venice, 1559), pp. 155ff.
14. H. Leclerc, *op. cit.*, fig. 1, pl. XIX.
15. L. Sirigatti, *La Prattica di Prospettiva* (Venice, 1595), chapter XLIII.
16. J. Furttenbach, *Architectura recreationis* (Augsburg, 1640), pp. 59–70, pls. 21–3; N. Sabbattini, *Pratica di fabricar scene e machine ne' teatri* (Ravenna, 1638); G. Troili, *Paradossi per pratticare la prospettiva* (Bologna, 1672), pp. 110–13.
17. F. Clerici, *op. cit.*, p. 105 and fig. 128; P. Portoghesi, *Borromini architettura come linguaggio* (Rome–Milan, 1967), pp. 170–2, pl. LXXV and LXXVI, figs. 132 and 133.
18. A. Dürer, *Institutionum geometricarum libri quatuor . . .* (Nuremberg, 1525), pp. 87, 91, 92 and 116; S. Serlio, *Il primo Libro di Architettura* (Paris, 1545), p. 9.
19. See J. Pennethorne, *The Geometry and Optics of Ancient Architecture* (London, 1878), p. 15, and A. Choisy, *Histoire de l'architecture*, I (Paris, 1899), p. 403.
20. D. Polienus (F. di Diano da Diano), *Occhio errante dalla ragione emendato, prospettiva* (Venice, 1628), p. 121; S. de Caus, *La Perspective avec la raison des ombres et des miroirs* (London, 1612), p. 37; C. Mydorge, *Examen du Livre des récréations mathématiques* (Paris, 1630), part 2, p. 30.
21. G. Troili, *op. cit.*, p. 119.
22. J.-F. Niceron, *La Perspective curieuse* (Paris, 1638), p. 12; A. Kircher, *Ars magna* (Rome, 1646), p. 192, fig. p. 114. The story is related, also from Tzetzes, by François Blondel (*Cours d'architecture enseigné dans l'Académie Royale*, Paris, 1675–83, pp 709–10), who also mentions optical rectifications of Vitruvius and Serlio. On the other hand, he uses Trajan's Column to show that these corrections are not always necessary: all the figures in it are of the same height, and yet visible. The author concludes: 'I do not know the exact rules which determine the mean between the actual measurements and those produced by perspective.'
23. Quoted from J. P. Lomazzo, *Traité de la proportion naturelle et artificielle des choses*, translated by H. Pader (Toulouse, 1649), p. 10.
24. R. F. de Chantelou, *Euclid*, *op. cit.*, pp. 13–14.
25. *Mémoires de Charles Perrault* (Avignon, 1759), book II, p. 109. Relating that he had the measurements of the Trajan's Column taken by Girardon, the Comptroller of the buildings of Louis XIV criticises Chantelou's theory in violent terms: 'The good man did not know what he was talking about'. For the dimensions of the monument, see C. Percier, *La Colonne Trajane* (Paris, 1877), p. 7.
26. Charles de Tolnay, *Michel-Ange* (Paris, 1951), pp. 75ff; and *Werk und Weltbild des Michelangelo* (Zurich, 1949), pp. 89–90. The author, referring to the composition with unequal figures in *The Last Judgement*, draws our attention to the fact that in the contract for the Piccolomini Monument at Siena (1504), Michelangelo states that the top figures should be the width of a hand larger than those in the lower part. It is also specified in the contract for the monument of Julius II (1513) that in the little chapel on the summit of the monument there should be five figures larger than the others 'since they are further from the eye'. This, incidentally, was the tomb which Julius II wanted erected in his own lifetime. Originally there were to be forty figures, but in the second contract, that of 1513, the number was reduced. It was finally partially carried out in 1545, in San Pietro in Vincoli, Rome.
27. For optical corrections, see also M. C. Ghyka, *Le Nombre d'Or*, vol. I, 'Les Rythmes' (Paris, 1931), pp. 89–95.

CHAPTER TWO: FIRST ANAMORPHOSES

1. G. Hugnet, *Fantastic Art, Dada, Surrealism* (New York, 1946), fig. p. 77; see also *Cahiers d'art* (1937). The two panels seem to have come from an auction at the Hôtel Drouot (3 April 1925).
2. H. Röttinger, *Erhard Schön und Niklas Stör* (Strasbourg, 1921), no. 205 of the catalogue. The plate has been restored by uniting two fragments. Another plate, with

Pope Paul III instead of Pope Clement VII, is reproduced by M. Geisberg, catalogue No. 1197.

3. The compositions should be viewed alternately from the left and right side.
4. A. von Bartsch, *Le Peintre-graveur*, IX (Vienna, 1808), p. 151; R. F. Lichtenberg, *Uber den Humor bei den deutschen Kupferstechern und Holzschnittkünstlern* (Strasbourg, 1897), p. 51; Campbell Dodgson, *Catalogue*, vol. I (London 1903), pp. 551–2; H. Röttinger, *op. cit.*, nos. 203 and 204 of the catalogue.
5. L. Dimier, 'La Perspective des peintres et les amusements optiques dans l'ancienne école de peinture', *Bulletin de la Société de l'Histoire de l'Art français* (1925), p. 12.
6. P. Hentzner, *Itinerarium Germaniae, Galliae, Angliae, Italiae* (Breslau, 1617), subsequently published by Horace Walpole, *A Journey into England in the year MDXCVIII* (Strawberry Hill, 1757), p. 32.
7. Horace Walpole, *Anecdotes of Painting in England* (London, 1826), vol. I, p. 228. L. Wornum's attribution is given in his edition of the *Anecdotes* (1849), vol. I, p. 135, n. 2.
8. N. Beats, *Cornelis Athonisz, Out-Holland* (1939), p. 212. For this series see also James Byam Shaw, 'The Perspective Picture, a Freak of German Sixteenth-Century Art', *Apollo*, VI (1927), p. 208–14.
9. New York, The Metropolitan Museum of Art, donor Janos Scholz (1963), phot. M.M. 36497.
10. Richard II, Act II, sc. 2. The passage is mentioned by Panofsky, 'The Codex Huygens' p. 93, n. 1.
11. We know that the Lord Chamberlain's Men presented plays at the Palace of Whitehall in, for example, January and February 1598. cf. E. K. Chambers, *William Shakespeare, A Study of Facts and Problems*, II (Oxford, 1930), p. 321.
12. Abbé J. A. Guyard, *Histoire de saint Antoine de Padoue* (Montauban, 1860), and P. Cahier, *Caractéristique des saints* (Paris, 1867), pp. 57 and 292.
13. The picture measures 54 cm. × 86 cm. All the information about it was given to me by Signorina Mimi Bazzi of Milan, who obtained it from a Volpi Collection. An examination under ultraviolet rays confirms the unity of the work. The support is a single panel of pinewood. The technical skill and certain details suggest a German artist.
14. The picture is 43 cm. × 96 cm. It is the property of C. Cacetta and is in the Galleria San Marco, Rome. I am indebted to Mario Praz for the photograph.
15. The picture, which was sold in Amsterdam in 1938, was mentioned to me by A. van Schendel, to whom I am indebted for the reproduction. It seems that this is only part of the composition, which has been cut down on at least three of the four sides.
16. Dr. Werner Janssen of Godesberg, its owner, drew my attention to this picture. It confirms the observation in note 15 concerning the cutting down of the composition.
17. The engraving belongs to the Hennin Collection, in the Bibliothèque Nationale, vol. XXVI, no. 2239.
18. J. Böttinger, *Philipp Hainhofer und der Kunstschrank Gustav Adolfs in Upsala* (Stockholm, 1909), vol. I, p. 32. The anamorphic portrait of Ernest, Duke of Bavaria and Elector of Cologne, executed by J. Stommel in 1595, is described by J. Gürtler, *Die Bildniss[e] der Erzbischoffe und Kurfürsten von Köln* (Strasbourg, 1912), pp. 28 and 58, no. 22 of the catalogue. For *Wunderkammern* in general, see J. von Schlosser, *Kunst- und Wunderkammern der Spät-renaissance* (Leipzig, 1908).
19. Mr Anthony d'Offay's Collection, London. The same engraving is in the Ashmolean Museum, Oxford.
20. G. Barozzi da Vignola, *Le due regole della prospettiva pratica* (Rome, 1583), p. 96. According to T. K. Kitao ('Prejudice in Perspective: A Study of Vignola's Perspective Treatise', *The Art Bulletin*, XLIV (1962), p. 189, n. 53), the illustrations are by Danti, unless there are reasons for thinking that the wood engraving was done after a drawing by Vignola. The archaism of the squaring system could be one.

    In her attempts to claim a French origin for these anamorphic compositions, Mme. L. Brion-Guerry in *Jean Pélerin Viator, sa place dans l'histoire de la perspective* (Paris, 1962), p. 145, bases her case on the same book: 'Vignola, in the chapter he devotes to anamorphoses, states that the oldest 'secret portraits' which were seen in Italy had a French origin and one represented Francis I, the other Henry II as a child.' The book quoted does not allude to anamorphoses, which, by definition, imply a violent distortion of elongated figures. The system in question involves cutting-up a normal picture, painted on a wooden panel, into oblong strips, which are then joined up again in such a way that the picture can only be seen in a tilted mirror. The description of the process is entitled: 'how those pictures are done which cannot be seen by the eye unless they are reflected in the mirror' (Vignola, *op. cit.*, p. 94). For Vignola, see also H. Willich, 'Giacomo Barozzi da Vignola, nella storia della prospettiva,' *Periodico di matematiche*, XXXI, 2 (1953), pp. 73–103 and *Il Vignola* (Trieste, 1960).
21. J.-B. della Porta, *Magiae naturalis, Liber IV* (Naples, 1558, and Antwerp, 1561);

La Magie naturelle (Rouen, 1612, and Lyon, 1650), book IV, preface, quoted by G. Rodis-Lewis, in an article on French anamorphoses: 'Machinerie et Perspectives curieuses dans leur rapport avec le cartésianisme', *Bulletin de la Société d'Etudes du XVIIe. siècle* (1956), p. 465.

22. D. Barbaro, *La pratica della perspettiva* (Venice, 1559 and 1563), pp. 159–61.
23. G. P. Lomazzo, *Trattato dell'arte della Pittura* (Milan, 1584 and 1589), pp. 335–6.
24. For Leonardo's anamorphosis of the lion and the dragon, see C. Pedretti, 'Un sagetto anamorphotico de Leonardo ricordato dal Lomazzo (la zutta dei drago col leone)', *L'Arte*, LX (1956), pp. 12–30.
25. Leonardo da Vinci, *Codex Atlanticus*, Biblioteca Ambrosiana, Milan, facsimile ed. (Milan, 1894), fol. 35. The translation is from A. Chastel and R. Klein, *Léonard de Vinci, Traité de la Peinture* (Paris, 1960), p. 108. See also F. S. Bassoli, 'Leonardo da Vinci e l'invenzione delle anamorfosi', *Arti della Societa dei Naturalisti e Matematici di Modena*, LXIX (Modena, 1918), pp. 8ff.; C. Pedretti, *Documenti e memorie riguardanti Leonardo da Vinci a Bologna* (Bologna, 1953), p. 121ff, and *Studi Vinciani* (Geneva, 1957), nos. 25 and 26.
26. P. Accolti, *Lo Inganno degl'occhi, prospettiva pratica* (Florence, 1625), p. 49.
27. M. Thausing, *Dürers Briefe, Tagebücher und Reime* (Vienna, 1872), p. 23, and C. Narrey, *Albert Dürer à Venise et dans les Pays Bas* (Paris, 1866), p. 75. The letter was written about 13 October 1506, a few months before Dürer's return to Nuremberg. According to Thausing, the scholar in question was Luca Pacioli, the author of the treatise on *Divina Proportione*. According to P. Speciali in 'Vinci et la Divina Proportione', *Bibliothèque d'Humanisme et Renaissance*, vol. XV, No. 3 (Geneva, September 1953) referring to E. Bortolotti (*La storia della matematica nella Università di Bologna*, Bologna, 1947), at Bologna, Dürer was the pupil of Scipione dal Ferro, around whom an important scientific School – to which Pacioli also belonged – had just been formed.
28. By mentioning 'the anamorphic rule' as a 'game' in contrast to the 'art' of perspective, J. J. Schübler (*Perspectiva, pes-picturae* Nuremberg, 1719–20, II, p. 48) puts it in direct relation to the optical deformations of Dürer.
29. The pen drawing is preserved in the University Library of Erlange, see E. Bock, 'Die Zeichnungen in der Universitätsbibliothek Erlangen', *Die Kataloge der Prestel-Gesellschaft* (Frankfurt A.M., 1929), no. 448.
30. S. Marolois, *Perspective contenant la théorie et pratique d'icelle* (The Hague, 1614), p. 280.
31. M. Bettini, 'Apiaria universae philosophiae mathematicae', *Apiarium V* (Bologna, 1642), p. 26.

CHAPTER THREE: FRENCH MASTERS OF PERSPECTIVE

1. S. de Caus, *Institution harmonique* (Frankfurt A.M., 1615); *Les Raisons des forces mouvantes* (Frankfurt A.M., 1615); *Horloges solaires* (Paris, 1624); *Les proportions tirées du premier livre d'Euclide* (Paris, 1624).
2. S. de Caus, *La Perspective avec la raison des ombres et miroirs* (London, 1612 and Paris, 1624).
3. J.-F. Niceron, *La Perspective curieuse ou magie artificielle des effets merveilleux* (Paris, 1638).
4. J.-F. Niceron, *Thaumaturgus opticus, seu Admiranda optices per radium directum, catoptrices per radium reflectum* (Paris, 1646).
5. J.-F. Niceron, *La Perspective curieuse . . .* (Paris, 1652 and 1663).
6. H. C. Agrippa, *De occulta philosophia*, Lib. II, chapter I, mentioned by G. Rodis-Lewis, *op. cit.*, p. 464, n. 20.
7. S. de Caus, *La Perspective . . .*, chapters XXVII–XXIX, n.p.
8. For the *costruzione legittima*, see W. H. Ivins, *op. cit.*; R. Klein, 'Pomonius Gauricus on Perspective', *The Art Bulletin*, XLIII (1961), p. 219; A. Parronchi, 'Il punctum dolens della "costruzione legittima",' *Paragone*, 145 (1962), pp. 52–72, and 'La costruzione legittima e ugaule alla costruzione con punti di distanza', *Rinascimento*, 15 (1964), pp. 35–40; T. K. Kitao, *op. cit.*, p. 177; C. Grayson, 'L.-B. Alberti's costruzione legittima', *Italian Studies*, 19 (1964), pp. 14–28; S. Y. Edgerton, *op. cit.* See also Viator (Jean Pélerin), *De artificiali perspectiva* (Toul, 1505), p. 9.
9. Fr. Du Breuil, *La Perspective pratique*, III (Paris, 1649), p. 109ff.
10. J.-F. Niceron, *op. cit.* (ed. 1638), p. 56.
11. Fr. Du Breuil, *op. cit.*, III, pl. 12.
12. Ludovico Ricchieri (Coelius Rhodiginus), *Lectionum antiquarum libri XVI* (Basle, 1517), p. 549.
13. J.-F. Niceron, *op. cit.* (ed. 1638), pp. 70 and 72.
14. See G. Vasari, *Vie des peintres, sculpteurs et architectes* (Paris, 1842), p. 251.
15. J.-F. Niceron, *op. cit.* (ed. 1663), p. 125ff.

16. F. Titi (*Descrizione delle pitture, sculture e architecture*, Rome, 1763, p. 380) mentions the two frescoes of S. Trinità dei Monti as the work of Niceron. As in the Minim monastery in Paris, they were painted in the upper galleries of the cloister.
17. A. N. Dézallier d'Argenville, *Voyage pittoresque de Paris* (Paris, 1749), p. 167. These two frescoes are also mentioned by G. Brice, *Description nouvelle de la ville de Paris*, I (Paris, 1698), p. 336 and in Diderot's *Encyclopédie*, vol. I (Paris, 1751), p. 405.
18. L. V. Thiery, *Guide des amateurs et des étrangers voyageurs à Paris* (Paris, 1787), I, p. 683.
19. L. Salerno, *Eglise et couvent de la Trinité-des-Monts à Rome* (Bologna, 1968), plates 30 and 31. See also E. Castelli, *Simboli e imagini, Studi di filosofia dell'Arte Sacra* (Rome, 1966), pls. XXXIX and XL. For the miracle of the saint crossing the Straits of Messina with his mantle spread over the waters, see Fr. F. Giry, *La vie de saint François de Paule* (Paris, 1681), p. 93ff.
20. E. Maignan, *Perspectiva horaria, sive de Horographia gnomonica . . . libri quatuor* (Rome, 1648), p. 438ff. On the engraving the gallery is not vaulted. The background wall was decorated with a landscape which prolonged the anamorphic view but which has since disappeared. A sundial was placed by Fr. Maignan beside a cloister window. The monastery possessed a museum of curiosities with scientific instruments and an important library.
21. A. Dürer, *Institutionem geometricarum libri quatuor* (Nuremberg, 1525).
22. P. Accolti, *op. cit.*, p. 80.
23. E. Panofsky, *Galileus as a Critic of the Art* (The Hague, 1954), p. 13 and *Galileo, Opera*, IX, p. 129. A comparison between the formal duality of an anamorphosis and the structure of a symbol in which one idea is expressed by another has been undertaken by M. V. David, *Le débat sur les écritures et l'hiéroglyphe aux XVIIe. et XVIIIe. siècles* (Paris, 1965), see Appendix I, *Le symbolisme des anamorphoses*, pp. 141–2.
24. J.-F. Niceron, *op. cit.* (ed. 1663), p. 125.
25. *Ibid.*, p. 150.
26. The entertainment was given ten years after Niceron's death, on 6 September 1656, and a description of it was published the same year by Ballard, the publisher of Court Ballets, under the title: *Relations de ce qui s'est passé à l'arrivée de la reine Christine de Suède à Essaune, en la maison de M. Hesselin* (Paris, 1656). For the fantastic aspect and the philosophy of illusion in the seventeenth century in France, see J. Rousset, *La Littérature de l'âge baroque en France, Circé et le Paon* (Paris, 1953).
27. J.-F. Niceron, *L'Interprétation des chiffres* (Paris, 1641).
28. *Annales de l'Ordre des Religieux Minimes* (Paris, 1763), p. 159, Bibliothèque Nationale, French Ms. 23126.
29. I.-L. Sr. de Vaulezard, *Perspective cylindrique et conique* (Paris, 1630).

CHAPTER FOUR: DESCARTES

1. A. Baillet, *La Vie de M. Des Cartes* (Paris, 1691); Hilarion de Coste, *La Vie de Père Mersenne* (Paris, 1649); 'Notes sur la Vie de Mersenne', in *Correspondance du P. Marin Mersenne, religieux Minime*, published by Mme Paul Tannery, edited and annotated by Cornelis de Waard (Paris, 1932). On the importance of the Paris monastery of the Minim Order in intellectual life, on the international rôle of Fr. Mersenne and on his relations with Renaissance thought, see F. A. Yates, 'The French Academies of the Sixteenth Century', *Studies of the Warburg Institute*, XV (1947), pp. 284–90. Some 170 letters of the Descartes-Mersenne correspondence are published in 'Correspondance', *Oeuvres de Descartes*, vols. I–V, ed. C. Adam and P. Tannery (Paris, 1897–1903).
2. Fr. Marin Mersenne, *Synopsis mathematica* (Paris, 1626); *Questions inouyes ou Récréation des sçavans* (Paris, 1634); *Harmonie universelle* (Paris, 1636); *Optique* (Paris, 1651) (published posthumously). See R. Lenoble, *Mersenne ou la naissance du mécanisme* (Paris, 1943).
3. The anamorphosis is contrived for a cylindrical mirror. It is reproduced in an engraving by J. Picard in J. d'Auzoles, *Le Mercure charitable* (Paris, 1638), p. 73, cf. Jeanne Duportal, *Etude sur les livres à figures en France de 1601 à 1660* (Paris, 1914), p. 303.
4. This picture, dated 1635, is at present in the Science Museum, Florence, cf. J. Bousquet, 'Recherches sur le séjour des artistes français à Rome au XVIIe siècle', unpublished thesis of the Ecole du Louvre, January 1952. I owe this reference to Charles Sterling. The process is explained in *La Perspective curieuse* (ed. 1638), pp. 100ff., Book IV: *Dioptrique*, as '*recently invented*'. Niceron claimed to be the first to describe this marvel 'which, by means of lenses or polygonal and faceted crystals, shows in one picture in which fifteen or sixteen different and correctly proportioned portraits have been executed, a new figure, different from the others and likewise well-proportioned and resembling some predetermined object.' He had seen this carried out in front of him in Lyons by Fr. Dulieu, 'a man learned not only in these

mathematical subjects but also in the sciences of Philosophy and Theology', who, likewise, was not its inventor. No doubt the stay in Lyons was at the time of his first journey to Italy. He immediately carried out his own experiment on the picture in question.

5. C. Adam and P. Tannery, *op. cit.*, vol. II, p. 530.
6. Letter from Dom Viénot, Benedictine friar at Clerselier (dated Chartres, 24 May 1660), *ibid.*, vol. V, p. 375.
7. See C. Adam and P. Tannery, *op. cit.*, vol. VI, pp. 51–6.
8. See G. Rodis-Lewis, *op. cit.*, p. 464.
9. C. Adam and P. Tannery, *op. cit.*, vol. XI, pp. 130–1.
10. S. de Caus. *Les Raisons des forces mouvantes*, I, 'Problèmes VII et VIII', pls. 16 and 17, s.p. (Frankfurt A.M., 1615).
11. *Ibid.*, 'Problème XIV', pl. 14.
12. M. E. Montaigne, *Journal de Voyage*, published by L. Lautrey (Paris, 1906), p. 188. See D. Heilkamp, 'Les Merveilles de Pratolino', *L'Oeil*, No. 171 (March, 1969), pp. 16ff.
13. S. de Caus, *Les Raisons des forces mouvantes*, II, 'Problème XVI', pl. 16.
14. *Ibid.*, II, pl. 35.
15. G. Rodis-Lewis (*op. cit.*, p. 462) adds to these comparisons the extensive account that Salomon de Caus (*Les Raisons des forces mouvantes*, I, 'Problèmes XXVIII–XXXVIII', and the whole of Part III) devotes to games and to the manufacture of organs that Descartes ('L'Homme', C. Adam and P. Tannery, *op. cit.*, vol. XI, pp. 185–6) compares to the movements of animal spirits in the pores of the brain.
16. C. Adam and P. Tannery, *op. cit.*, vol. VI, p. 41.
17. *Ibid.*, vol. XI, pp. 161–3.
18. *Ibid.*, vol. VI, p. 113.
19. J.-F. Niceron, *op. cit.* (ed. 1638), p. 50.
20. E. Maignan, *Perspectiva horaria* (Rome, 1648), pp. 439ff., and see for this development G. Rodis-Lewis, *op. cit.*, pp. 471–3.
21. J.-F. Niceron, *op. cit.* (ed. 1638), p. 119.

CHAPTER FIVE: THE ARTISTS' QUARREL

1. *Exemple d'une manière universelle de S.G.D.L.* (*G. Desargues lyonnois*) *touchant la pratique de la perspective* (Paris, 1636). Only a few copies exist, one at the Bibliothèque Nationale (V. 1537), another at the Metropolitan Museum of Art, New York, cf. W. H. Ivins, 'Two First Editions of Desargues', *The Metropolitan Museum Bulletin* (1942), p. 47ff. The quotation occurs in C. Adam and P. Tannery, *op. cit.*, vol. I, p. 376, letter from Descartes to Mersenne, dated 25 May 1637.
2. N. G. Poudra, *Oeuvres de Desargues* (Paris, 1863); R. Taton, *L'Oeuvre mathématique de Girard Desargues* (Paris, 1951).
3. A. Bosse, *Manière universelle de M. Desargues pour pratiquer la perspective* (Paris, 1648) and *Moyen universel de pratiquer la perspective sur les tableaux ou surfaces irrégulières* (Paris, 1653).
4. The lectures were published in a separate work: A. Bosse, *Traité des partiques géométrales et perspectives enseignées dans l'Académie royale de la peinture et sculpture* (Paris, 1665). The dispute between Bosse and the Academy has been described in detail by A. Blum, *Abraham Bosse* (Paris, 1924), pp. 16–40; see also A. Fontaine, *Académiciens d'autrefois* (Paris, 1914), pp. 67–114: 'Le cas d'Abraham Bosse, histoire et analyse du conflit entre Bosse et l'Académie', and R. A. Weigert, *Abraham Bosse, le peintre converti aux règles de son art* (Paris, 1964), pp. 17ff.
5. G. Huret, *Optique de Portraiture et Peinture* (Paris, 1670).
6. *Ibid.*, sect. 217, p. 76.
7. *Ibid.*, sect. 187–98, pp. 61ff.
8. See fig. 3.
9. G. Huret, *op. cit.*, sect. 201–5, pp. 65–9, pl. VI.
10. The matter has been disputed by G. Kauffmann (*Poussin Studien* (Berlin, 1960), p. 77 note 56), according to whom Huret, in sections 187, 198 and 209, protests against the practice of these anamorphoses. These sections concern the establishment of perspective in normal pictures by the use of geometrical rules, and compositions on the irregular surfaces of vaulted roofs.

CHAPTER SIX: GERMAN VISIONARIES

1. The vast bibliography on Athanasius Kircher is not listed here: it relates to too great a variety of questions. The catalogue of his *Wunderkammer* was compiled by P. Bonnani (*Museum Kircherianum*, Rome, 1709). In it are enumerated various ancient objects, plants, stuffed marine and land creatures, coins, mathematical instruments,

automata and other apparatus, mirrors and 'elegant figures represented from a certain point which if seen from elsewhere, however, appear confused'. For Kircher's relations with Descartes, see A. Baillet, *La Vie de M. Des Cartes* (Paris, 1621), II, p. 284. For Kircher the Egyptologist, hieroglyphist, and orientalist see J. Baltrušaitis, *Essai sur la légende d'un mythe: La Quête d'Isis; Introduction à l'Egyptomanie* (Paris, 1967), pp. 188ff., pp. 203ff., pp. 246ff.

2. A. Kircher, *Ars Magna lucis et umbrae in decem Libros digesta* (Rome, 1646).
3. *Ibid.*, pp. 124–8.
4. Dürer's 'window' appeared as early as 1514 and 1515 in the Dresden and London sketches respectively. Other variants of the apparatus, dating from 1525 and 1527, are in his Dresden sketchbook. Some of them were added in the second German edition of his treatise, published in 1538. See H. Tietze-Conrat, *Kritisches Verzeichnis des Werkes Albrecht Dürers* (Basle and Leipzig, 1938), nos. 622, 631, 934, 935, 975, 976, and also M. Schuritz, *Die Perspektive in der Kunst Albrecht Dürers* (Frankfurt A.M., 1919). The sketch is reproduced in R. Bruck, *Das Skizzenbuch von Albrecht Dürer in der Bibliothek zu Dresden* (Strasbourg, 1905), pl. 135 (177b).
5. L.-B. Alberti, *De la statue et de la peinture*, translated by C. Popelin (Paris, 1868), p. 140. For the *velo Alberti*, see J. Meder, *Die Handzeichnung, ihre Technik und Entwicklung* (Vienna, 1919), pp. 144ff.
6. The first two editions, Latin (*De Pictura . . . Leonis Baptistae Alberti*), and Italian (*La Pittura di Leonbattista Alberti*) are dated 1540 (Basle) and 1547 (Venice) respectively.
7. Michelangelo Biondo, *Della Nobilissima Pittura* (Venice, 1549), chapter VI, pp. 10–12.
8. A. Kircher, *Ars magna*, pp. 703–33.
9. Fragment copied by Leibnitz, cf. C. Adam and P. Tannery, *op. cit.*, vol. X, pp. 215–6, quoted by G. Rodis-Lewis, *op. cit.*, p. 464.
10. M. Bettini, 'Apiaria universae philosophiae mathematicae', *Apiarium*, V (Bologna, 1642), p. 32.
11. J. Baltrušaitis, *Le moyen âge fantastique* (Paris, 1955), pp. 211–20, published in English as *The Fantastic Middle Ages*, tr. by W. J. Strachan (Cambridge, 1977) and 'Le Paysage fantastique au moyen âge', *L'Oeil*, 10 (1955), pp. 18ff.
12. *Capricci e Bizzarie di varie figure di Giovanbatista Braccelli, pittore fiorentino, All' Illmo Sig. Don Pietro Medici* (1624). The complete collection has been published by A. Brieux, *Braccelli Bizzarie, l'aventure d'un livre*, with a *Propos sur Braccelli* by Tristan Tzara (Paris, 1963).
13. A. Kircher, *Ars magna*, fig. p. 709.
14. Cf. G. Hugnet, *Fantastic Art, Dada, Surrealism* (New York, 1946), fig. p. 83.
15. J. Böttiger, *Philipp Hainofer und der Kunstschrank Gustav Adolfs* (Stockholm, 1909), vol. IV, pl. 59, fig. 2.
16. *Ibid.*, vol. I, p. 33, letter from Hainhofer to Philip, Duke of Pomerania.
17. G. Schott, *Magia universalis naturae et artis* (Wurzburg, 1657), vol. I, p. 194, fig. p. 278.
18. A. Kircher, *op. cit.*, fig. p. 133.
19. For the habit of plagiarism without acknowledgement, often practised by Athanasius Kircher, see J. Baltrušaitis, *La Quête d'Isis*, pp. 188ff., pp. 203ff.
20. G. Schott, *Physica curiosa, sive mirabilia naturae et artis* (Nuremberg, 1662); *Joco-seriorum naturae et artis, sive magia naturalis* (Nuremberg, 1664); *Technica curiosa, sive mirabilia artis* (Nuremberg, 1664).
21. G. Schott, *Magia universalis*, vol. I, book III, *De Magia anamorphotica*, pp. 101–69.
22. *Ibid.*, p. 133, pl. VI, p. 140, pl. VII, p. 142, pl. VIII.
23. *Ibid.*, *Magia parastatica*, pp. 122ff.
24. *Ibid.*, p. 141.
25. S. de Caus, *La Perspective* . . . (London, 1612), 'Théorème dixième', s.p.; P. Accolti, *Lo Inganno degl'occhi* (Florence, 1625), p. 84.
26. For the place of anamorphic systems in the art and the thought of Mannerism, seem G. R. Hocke, *Die Welt als Labyrinth* (Hamburg, 1957), pp. 128–9.

CHAPTER SEVEN: HOLBEIN'S 'THE AMBASSADORS'

1. Mary F. S. Hervey, *Holbein's Ambassadors* (London, 1900); see also P. Ganz, *Hans Holbein der Jüngere* (Basle, 1949), p. 227, figs. 21 and 22. The picture was taken to France by Dinteville. It stayed there in his Polisy estate until the sale of the château in 1653. J.-B. Lebrun bought it in 1787 and resold it to a dealer in England. The National Gallery in London acquired it in 1890.
2. See E. Hutton, *The Cosmati, the Roman Marble-workers of the XIIth and XIIIth centuries* (London, 1950), pl. 63.
3. *Perspectivae Sintagma in quo varia* . . . (Amsterdam, 1629), frontispiece.

4. P. Accolti, *op. cit.*, p. 88.
5. E. Winternitz, 'Quattrocento Science in the Gubbio Study', *The Metropolitan Museum Bulletin* (1942), pp. 104–16. The frontispiece of the book by F. Gafurio (*Angelicum ac divinum opus musice* . . . Milan, 1496) also shows, juxtaposed, a musical instrument, organ pipes, a sand-glass, geometrical lines and a pair of compasses. For the crystallization of perspective systems in marquetry, see A. Chastel, 'Marqueterie et perspective au XVe siècle', *La Revue des Arts* (September, 1953), pp. 141ff.
6. C. Sterling, 'La Nature Morte de l'Antiquité à nos jours', *Catalogue de l'Exposition de l'Orangerie des Tuileries* (Paris, 1952), pp. 21ff.
7. *Ibid.*, pp. 11ff., no. 6. See also, by the same author, *La Nature Morte de l'Antiquité à nos jours* (Paris, 1952), pp. 26–7.
8. C. de Tolnay, 'L'Atelier de Vermeer', *Gazette des Beaux-Arts* (April 1953), p. 226.
9. Sir Thomas More, *La République d'Utopie* (Lyons, 1559), pp. 194–6.
10. Erasmus of Rotterdam, *De la Déclamation des louenges de follie* (Paris, 1520).
11. S. Brant, *Das Narrenschiff* (1494), translated by A. Barclay (London, 1509), folio CXXXIX.
12. Translations from Erasmus, *Encomium Moriae* (1509).
13. J.-P. Migne, *Patrologia Latina*, vol. 176, columns 709 and 710.
14. H. A. Schmid, *Erasmi Roterodami Encomium moriae i.e. Stultitiae laus, Lob der Torheit Basler Ausgabe von 1515, mit den Randzeichnungen von Hans Holbein d.J. in Faksimile* (Basle, 1931). (*In Praise of Folly . . . Basle edition of 1515 with the marginal drawings by Hans Holbein the Younger, in facsimile.*)
15. W. Hes, *Ambrosius Holbein* (Strasbourg, 1911), pl. XVII, pp. 83ff.
16. When Holbein set out for England in 1526, Erasmus provided him with letters of recommendation to Sir Thomas More, whose *Utopia*, published in Basle in 1518, had a frontispiece signed by Hans and two engravings by Ambrosius Holbein. For the detailed biography of the artist, see A. B. Chamberlain, *Hans Holbein the Younger* (London, 1913).
17. H. C. Agrippa, *De incertitudine et vanitate scientiarum et artium atque excellencia verbi Dei declamatio* (Antwerp, 1530).
18. Translations from the *Déclamation sur l'incertitude, vanité et abus des sciences et des arts* (Paris, 1582), pp. 2, 6, 7, 73, 86, 99, 102, 103, 129, 524.
19. A. Prost, *Corneille Agrippa* (Paris, 1881), vol. I, pp. 244ff.
20. H. Walpole, *Anecdotes of Painting in England* (London, 1826), vol. I, p. 119.
21. The frequent appearance of flies in *trompe-l'oeil* in still-life paintings of the sixteenth century has been discussed by A. Vassenbergh, *L'Art du portrait en Frise au XVIe siècle* (Leyden, 1934), p. 52, n. 2.
22. H. C. Agrippa, *op. cit.* (ed. 1582), pp. 528–30 and 540.
23. C. de Tolnay, 'L'Atelier de Vermeer', p. 270.
24. In her study of the pavement of the chancel of Westminster Abbey, as copied by Holbein, Mary F. S. Hervey (*op. cit.*, pp. 225ff.) discovered a six-pointed star in its composition which does not occur in the mosaic and which reminded her of the cabalistic signs of Cornelius Agrippa.
25. A. Prost, *op. cit.*, vol. II, p. 313.
26. P. Ganz, *Le portrait d'Erasme de Rotterdam de la collection Wildenstein* (Paris, 1913); 'Les Portraits d'Erasme de Rotterdam', *Revue de l'art ancien et moderne* (1932): *Die Erasmusbildnisse von Hans Holbein d.J., Gedenksschrift zum 400 Todestag des Erasmus von Rotterdam* (Basle, 1936), pp. 260ff.; *H. Holbein, die Gemälde* (Basle, 1950), pp. 221–2, nos. 55–60 of the catalogue. The portraits are spread over the years 1530 to 1532.
27. J. A. Schmoll, 'Zum Todesbewusstsein in Holbeins Bildnissen', *Kunstchronik* (September, 1952), pp. 239–42; H. Fortoul. *La Danse des Morts dessinée par Holbein* (Paris, n.d.); A. Götte, *H. Holbeins Totentanz und seine Vorbilder* (Strasbourg, 1897).
28. T. Frimmel, *Zur Kritik von Dürers Apokalypse und seines Wappens mit dem Todtenköpfe* (Vienna, 1884). A comparison of the *Coat-of-arms of Death* (*Blason de la Mort*) and Holbein's *Ambassadors* was made by R. N. Wornum, *Some Account of the Life and Works of Hans Holbein* (London, 1867), p. 180.
29. *Braque Triptych* by Rogier van der Weyden (c. 1450), Louvre; *Carondelet Diptych* by Jan Mabuse (1517), Louvre.
30. P. Ganz, *Hans Holbein der Jüngere*, p. 211, catalogue no. 29, fig. 9.
31. Charles Sterling has drawn attention to a large picture with an allegorical representation of the Dinteville family (Metropolitan Museum of New York) which was intended as a pendant to Holbein's *Ambassadors* in the Château of Polisy. If the arrangement was completely symmetrical, there must have been two doors at each side of the room.
32. In the first edition of this book, published in 1955, the picture was placed at a certain height with the anamorphic point of view of the skull below on the left. Monsieur J.-L. Gardies drew my attention to the fact that the left eye socket, being larger than

the right socket, is intended to be seen from further off. The skull should therefore be viewed from the opposite side, the door being 1.50 or 2.00m. away from the picture.

33. J.-F. Niceron, *La Perspective curieuse* (ed. 1638), pp. 50 and 51.
34. Lucas Brunn, *Praxis perspectivae. Das ist: von Verzeichnungen ein ausführlicher Bericht* (Leipzig, 1615), p. 55, pl. 24. (*The practice of perspective. That is: a detailed account with drawings.*)
35. The apparatus reproduced in plate 14 of the book comprises a panel, a frame, two vertical sticks and a movable arm. It is shown together with the instruments of Dürer and Jamnitzer by J.-J. Schübler, *Perspectiva, pes-picturae* (Nuremberg, 1719–20), figs. 15 and 16, who attributes it to Johann Herden.
36. Fr. Du Breuil, *La Perspective pratique*, III (Paris, 1649), treatise VI, *La Catoptrique*, p. 142.
37. Gripsholm, *Ett slott och dess Konstskatter, En konstbok fran Nationalmuseum redigerad av Boo von Malmborg* (Stockholm, 1956), pp. 80–1. The anamorphosis was brought to my notice by C. Nordenfalk.
38. I. Bergström, *Holländskt Stillebenmalerei under 1600-talet* (Göteborg, 1947), chapter IV, pp. 161–96.
39. C. Sterling, *Catalogue*, pp. 57–8.
40. For the representation of globes, see F. de Dainville, 'Les amateurs de globes', *Gazette des Beaux-Arts* (January, 1968).
41. S. de Caus, *Institution harmonique* (Frankfurt A.M., 1615), p. 24.
42. J. Kepler, *Prodromus dissertationum cosmographiarum* (Tübingen, 1596; 2nd ed., Frankfurt A.M., 1622).
43. R. Fludd, *De Macrocosmi historia* (Oppenheim, 1617), book III, fig. p. 90. Fludd's theories were attacked by J. Kepler in *Harmonices mundi libri V* (Linz, 1619). Fludd replied with a work entitled *Monochordum mundi symphoniacum* (Frankfurt, 1623), in which he reproduced another figure of a cosmic stringed instrument.
44. M. Mersenne, *Harmonie universelle* (Paris, 1636), see book I, p. 43, book III, p. 168 and book VIII, p. 18. The drawing of the cosmic lute was borrowed from R. Fludd's *Macrocosmi historia.*
45. C. A. Jombert, *Catalogue raisonné de l'oeuvre de Sébastien Leclerc* (Paris, 1774), p. LXII, no. 263, pp. 139ff.; E. Meaume. *Sébastien Leclerc* (Paris, 1877), pp. 243ff.
46. Collection Bernard Monnier, Paris. The picture was shown in the exhibition *Le Cabinet de l'amateur* (Orangerie des Tuileries, 1956), catalogue no. 71, p. 21. Despite what is stated in the entry, Sébastien Leclerc's engraving is not reversed, but we know of two copies which are: by Pacot and by an anonymous artist.
47. The inscription does not exist in the painting.
48. S. de Caus, *La Perspective . . .*, pl. 44.
49. J.-F. Niceron, *op. cit.* (ed. 1638), pp. 100ff., pl. 23, see above, chapter four, note 4.
50. C. de Molinet, *Le Cabinet de la Bibliothèque Sainte Geneviève* (Paris, 1692), pl. 7.
51. C. A. Jombert, *op. cit.*, p. 131.
52. Memoir of Camusat, Canon of Troyes, *Bibliothèque de l'Institut*, see Mary F. S. Hervey, *op. cit.*, p. 20.
53. At the time of the second marriage of the Marquis of Cessac, to Anne Louise de Broglie, in 1669, the painting was still in Paris but at a different address. It was subsequently lost track of until 1787 (the Beaujon sale), but there is nothing to prove that it was not taken by its owner to the Château de Milhars in the Languedoc in the meantime.
54. See C. A. Jombert, *op. cit.*, pp. XXXVIIff.; E. Meaune, *op. cit.*, pp. 55ff.; P. Chenut, 'Sébastien Leclerc graveur messin', in *Guide et catalogue de l'Exposition à l'occasion du IIIe centenaire de S. Leclerc*, Metz Museum (Nancy, 1937), pp. 8ff.
55. A *Traité de géométrie* by S. Leclerc was published in Paris in 1690.
56. C. A. Jombert, no. 310. The drawing is preserved in the library of the École des Beaux-Arts, see Metz Exhibition, *Catalogue*, p. 24.

CHAPTER EIGHT: OPTICAL DIVERSIONS

1. A. Baillet, *La vie de M. Des Cartes* (Paris, 1691), p. 320.
2. C. Mydorge, *La seconde partie des récréations mathématiques* (Paris, 1630), pp. 32–3; Van Etten (Fr. J. Leurechon), *Récréations mathématiques* (Bar-le-Duc, 1624).
3. C. Ozanam, *Cours de mathématiques*, vol. IV, *Traité de perspective pratique* (Paris, 1693) and *Cours de mathématiques et physiques* (Paris, 1694), pp. 238 and 241.
4. M. Bettini, 'Apiaria', *Apiarium IV and V* (Bologna, 1642).
5. J. C. Sturm, *Mathesis juvenilis* (Nuremberg, 1704), pp. 68–82, fig. XXVIII and *Mathesis compendiaria* (Coburg, 1714), p. 31, fig. 7; C. Wolf, *Elementa matheseos universae*, II (Halle, 1715), chapter V, pp. 113–5.
6. C. Wolf, *Cours de mathématiques*, II (Paris, 1747), pp. 83ff., 110–2, pl. V, fig. 6.

7. *Encyclopédie ou dictionnaire raisonné des sciences et des métires*, I (Paris, 1751), pp. 404ff.
8. B. Lamy, *Traité de perspective* (Paris, 1705), figs. pp. 180 and 183.
9. F. Galli Bibiena, *Direzioni della Prospettiva teorica corrispondenti a quelle dell'architettura* (Bologna, 1732 and Venice, 1796), pl. 43 and pp. 73–5.
10. The engraving is in the British Museum, see J. Byam Shaw 'The Perspective Picture, a Freak . . .', *Apollo, VI* (1927), p. 211.
11. J.-B. Lavit, *Traité de perspective* (Paris, 1804), vol. II, 'Anamorphoses', pp. 129–98.
12. Edgar Allan Poe, *Ligeia* (1838).
13. J.-B. Lebrun, *Galerie des Portraits flamands, hollandais, et allemands* (Paris, 1791), pl. 139, engraved by J.-A. Pierron. This copy postdates the sale of the picture by J.-B. Lebrun in England.
14. R. Z. Becker, *Holzschnitte, Gravure en bois* (Gotha, 1808), fig. 59. The figure is based on E. Schön, *Unterweysung der Proportion und Stellung der Bossen* (Nuremberg, 1538 or 1543).
15. L. Garcin, 'Grandville, visionnaire, surréaliste, expressionniste', *Gazette des Beaux-Arts* (December, 1948); J. Grandville, *Un Autre Monde* (Paris, 1844), *Les Grands et les Petits.*
16. Bibliothèque Nationale, Vinck collection, vol. 75, no. 9804 and Hennin collection, no. 13785.
17. Bibliothèque Nationale, Print room, Tb. mat. 3. The date 1868 is given by the seal of the *Dépôt légal.*
18. See G. Hugnet, *op. cit.*, and 'Quelques ancêtres du surréalisme', *Catalogue de l'exposition à la Bibliothèque nationale* (1965), nos. 68, pp. 70–81.

CHAPTER NINE: MIRROR ANAMORPHOSES

1. The first draft of these two final chapters was incorporated in J. Baltrušaitis 'L'Anamorphose à miroir à la lumière des découvertes nouvelles', *La Revue des Arts* (1956), pp. 85–98.
2. H. Walpole, *Anecdotes of Painting in England* (1762; London, 1826), vol. I, p. 228.
3. P. Hentzner, *A Journey into England in the year MDXCVIII*, ed. H. Walpole (Strawberry Hill, 1757), p. 32. See above, chapter 2, note 6.
4. *Encyclopédie ou dictionnaire raisonné* . . . I, p. 405. I indicated in the previous chapter (chapter 8, note 5) that the article in question is based on a text by C. Wolf (1715).
5. L. Dimier, 'La perspective des peintres et les amusements d'optique dans l'ancienne école de peinture', *Bulletin de la Société de l'Histoire de l'Art français* (1925), pp. 14ff.
6. Important documentation on anamorphoses has been assembled by Hans Haug and Jacques Wilhelm in France, and by Heinrich Schwarz in the USA.
7. See F. Brulliot, *Dictionnaire des Monogrammes*, III (Munich, 1832), p. 49, no. 315 and G. K. Nagler, *Neues allgemeines Künstler-Lexikon*, I (Munich, 1835), p. 222. My attention was drawn to these drawings by J. Wilhelm.
8. A very large number of series have been counted since the awakening of interest in these optical arrangements. Important series have been discovered in various collections. When he was completing the Exhibition of Anamorphoses for the Rijksmuseum, Amsterdam, and the Musée des Arts Décoratifs, Paris (1975–6), Olivier Lépire had a wide choice: gouaches, engravings, coloured lithographs, drawings. The Conservatoire des Arts et Métiers, Paris, has nearly 400, the Institut de Recherches et de Documentation Pédagogique, Paris, nearly 200, of the eighteenth and nineteenth centuries. The Print Room of the Bibliothèque Nationale preserves, under the classification Tb. mat. 3, several late examples of anamorphoses, one series of which was published from 1840 by V. Sies, who announced that 'every year the editor will bring out new examples of these mirror pictures'. A cylindrical anamorphosis of the eighteenth century (Jack of Clubs) is reproduced by J.-P. Sequin, *Le jeu de cartes* (Paris 1968), pl. p. 253.
9. N. Grollier de Servières, *Description du Cabinet* . . . (Lyons, 1719), p. 22; E. Bonaffe, *Dictionnaire des amateurs français du XVIIe siècle* (Paris, 1884), p. 291.
10. P. M. Terzago, *Museum Septalianum* (Tortone, 1664), p. 5.
11. O. Jacobaeus, *Museum regium* . . . (Copenhagen, 1696), p. 67.
12. O. Worm, *Museum Wormianum* . . . (Leyden, 1655), p. 354.
13. J. Böttiger, *Philipp Hainhofer und der Kunstschrank Gustav-Adolfs in Upsala* (Stockholm, 1909), vol. I, p. 32, vol. II, pp. 54–5, vol. IV, pl. XLIX.
14. The photograph, taken in 1955 by the Rijksmuseum, Amsterdam, was sent to me by A. van Schendel with the relevant information. The painting, then in the possession of R. Korteweg, has recently been acquired by J. Elffers (Amsterdam). The anamorphosis from the collection of Maître M. Rheims is reproduced in the *Catalogue* of the 'Anamorphoses' Exhibition of the Rijksmuseum, Amsterdam, and the Musée des Arts Décoratifs de Paris, 1975–6, pl. 55. I am obliged to Mlle. Olga Popovitch for the

reproduction of the anamorphosis from Rouen Museum.

15. Anamorphic mirror paintings are preserved, among other places, at the Bavarian National Museum in Munich, at the Basle Historical Museum (three anamorphoses attributed to J. H. Glaser), at the Utrecht Museum and at the Science Museum, London (nos. 4–6, 11 and 20 in the *Catalogue* of the Amsterdam–Paris Exhibition).
16. The ten paintings, of which we have photographs by D. Schiff, were bought in Amsterdam by H. Tannenbaum in 1939. They were sold for $16,800 at Sotheby's in 1973 to Apollooni, an antique-dealer from Rome. Eight of them are now in a private collection in Milan, two are back in Amsterdam, acquired by J. Elffers and M. Schuyt. See M. Gardner, 'Mathematical Games. The curious magic of anamorphic art', *Scientific American*, vol. 232, no. 1 (January 1975). The attribution of the entire series to Henry Kettle, active c. 1770, was made (see the *Catalogue* of the Amsterdam–Paris Exhibition, no. 29) by comparing a conical anamorphosis from the former Tannenbaum collection with a cylindrical anamorphosis in the Leyden Museum (fig. 97) signed Han: Kettle, representing the same hunt.
17. Niceron's model has been reproduced in an engraving by J. Lenfant in the Print Room of the Bibliothèque Nationale, Vouet Collection (Da 8, pl. 62). The same arrangement is repeated in a printed panel in the National Art Gallery, Rome, where it is part of a series of four pictures, all of the same format (50 × 67 cm.) and certainly by the same hand, comprising a portrait of Louis XIII similar to that of Vaulezard (1620) and to Niceron's frontispiece (1638), Louis XIII at prayer, an embracing couple and a lovers' 'go-between'. The whole series has been attributed to Niceron himself, who could have painted it during his first stay in Rome in 1635 (*Catalogue* of the Amsterdam–Paris Exhibition, nos. 7–10, notes 53 and 54), i.e., before the publication of his book. Two points should however be borne in mind: the copy of the first anamorphosis after Vouet (*St. Paul*) was in Paris and the presence of a *scène galante* is not in accordance with the style of Niceron, who never indulged in fantasies of this kind.
18. G. Wildenstein, *Lancret* (Paris, 1924), p. 92, no. 328, at present in the Fitzwilliam Museum, Cambridge. The scholarship of Charles Sterling has been of great help in the author's researches into identification. See also E. Bocher, *Catalogue raisonné des estampes . . .*, IV, *Nicolas Lancret* (Paris, 1877), pp. 44–5, no. 58.
19. See W. Bernt, *Die Niederländischen Maler des 17. Jahrh* (Munich, 1848), no. 766. The same monkey appears in another picture by F. Snyders, cf. J. Bouchot-Saupique, *La peinture flamande du XVIIe siècle au Musée du Louvre* (Brussels, 1947), pl. XXXIII.
20. A.-P.-F. Robert Dumesnil, *Le Peintre-Graveur français*, IV (Paris, 1883), p. 273, no. 61; L. Demonts, 'Décoration peinte par Simon Vouet pour Claude de Buillon', *Bulletin de la Société de l'Art français* (1913), p. 69; M. Fenaille, *Etat général des Tapisseries de la Manufacture des Gobelins, 1600–1662* (Paris, 1923), pp. 337–8.
21. In the original there are four greyhounds, in Dorigny's engraving two, in a copy of 1641 a single one.
22. G. K. Nagler, *Künstler-Lexikon*, XIX (Munich, 1848), p. 120, no. 20, with the following interpretation: 'Several satyrs round a table, in a garden, are looking at an elephant in a glass vessel and its enlarged shadow.'
23. Reproduced in Jacques d'Auzoles, *Le Mercure charitable* (Paris, 1638), p. 73, see above, chapter 4, note 3.
24. A. N. Dézallier d'Argenville, *Abrégé de la vie des plus fameux peintres*, IV (Paris, 1762), p. 17.
25. Vouet's frontispiece, engraved by K. Audran, was made for the second edition of Niceron's *Thaumaturgus opticus* (Paris, 1646).
26. Niceron's model was reproduced in an engraving by J. Lenfant, classified in the Print Room of the Bibliothèque Nationale in the *Recueil Vouet* (Da 8, pl. 62).
27. E. Langlois, *Le Roman de la Rose* (Paris, 1922), vol. IV, l. 1804–5; Jean Pena, *Euclidis optica et catoptrica* (Paris, 1557); L. Nix and W. Schmidt, *Herons von Alexandria Mechanik undKatoptrik*, Teubner 128 (Leipzig, 1900). See also G. Paré, *Les idées et les lettres au XIIIe siècle* (Montreal, 1947), pp. 254ff.
28. See F. Risner, *Vitellonis Thuringopoloni opticae libri X* (Basle, 1572), book VII, p. 60 and book IX, p. 25; see *ibid.*, *Opticae Thesaurus Alhazeni libri VII*. Vitellion proposes that convex mirrors be used for the cylinder which projects figures in the air. This has been considered an error. His commentators and interpreters have advocated concave mirrors for these illusions.
29. H. C. Agrippa, *De incertitudine et vanitate scientarium et artium* (Antwerp, 1530), and *Déclamation sur l'incertitude, vanité et abus des sciences et des arts* (Paris, 1582), chapter XXVI, p. 107.
30. J. Pena, *op. cit.*, see Preface, fols. cc. *et seq.*
31. G.-B. della Porta, *Magia naturalis* (Antwerp, 1561) and *Magie naturelle mise en quatre livres* (Rouen, 1680), book IV. See the same work in twenty volumes, *Magia*

naturalis (Naples, 1589), book XVII, chapter IX. For G.-B. della Porta, physiognomist, see J. Baltrusaitis, *Aberrations, quatre essais sur la légende des formes* (Paris, 1957), pp. 8ff.

32. See F. Maurolico, *Photismi de lumine et umbra* (Venice, 1575), p. 30; R. Mirami, *Compendiosa introduttione alla prima parte della scienza degli specchi* (Ferrare, 1582), see *Introduction.*
33. S. de Caus (*La Perspective avec la raison des ombres et miroirs*, London, 1612), who took his anamorphic theories a long way and whose erudition is beyond question, had not yet thought of this use of the mirror, which he employs, however, as a tool for obtaining correct perspective. S. Marolois (*Perspective contenant la théorie et pratique d'icelle*, The Hague, 1614) only gives examples of direct anamorphosis. In 1630 again, the year of Vaulezard's publication, Mydorge, although mentioning a direct anamorphosis (see above, chapter 8, note 2), like Leurichon (1624), shows 'miroirs bosses ou convexes, columnaires ou pyramidaux' only as the best distorting aids (*Examen du livre des récréations mathématiques*, Paris, 1630, pp. 199ff.)
34. I.-L. Seigneur de Vaulezard, *Perspective cylindrique et conique* (Paris, 1630); P. Hérigone, *Cinquième et dernier tôme du cours mathématique* (Paris, 1637), p. 216.
35. J.-F. Niceron, *La Perspective curieuse*, book III (Paris, 1638).
36. *Ibid.*, pp. 93 and 97.
37. Fr. Du Breuil, *La Perspective pratique*, III (Paris, 1649), fig. p. 147.
38. M. Bettini, 'Apiaria universae philosophiae mathematicae', *Apiarium V* (Bologna, 1642), figs. pp. 5 and 7.
39. A. Kircher, *Ars Magna lucis et umbrae* (Rome, 1646), pp. 134–6.
40. G. Schott, *Magia universalis naturae et artis*, vol. I (Wurzburg, 1657), *De anamorphosi catoptrica*, pp. 152–69.
41. C. Ozanam, *Récréations mathématiques et physiques* (Paris, 1694), vol. I, p. 247; J. C. Sturm, *Mathesis Juvenilis* (Nuremberg, 1704), pp. 127ff., and *Mathesis compendiaria* (Coburg, 1714), pp. 33ff.; C. Wolf, *Elementa matheseos universae* (Halle, 1715), pp. 183ff.; Abbé de la Caille, *Leçons élémentaires d'optique* (Paris, 1756), pp. 56ff.
42. F. Galli Bibiena, *Direzioni della Prospettiva teorica correspondanti a quella dell'architettura* (Bologna, 1732), pp. 90–1.
43. J. Leupold, in *Acta Eruditorum anno MDCCXII* (Leipzig, 1712), p. 273–274 and 367–368, and *Theatri machinarum supplementum*, Leipzig, 1739, cap. VII, § §89–96, pl. XVII and XVIII.
44. G. W. Leibnitz, *Nouveaux Essais*, book II, chapter XXIX, §8, ed. Raspe. The passage was quoted by V. David, *Le débat sur les écritures et l'hiéroglyphe aux XVIIe et XVIIIe siècles* (Paris, 1965), Appendice I, 'Le symbolisme des anamorphoses', pp. 141–2.
45. Fr. J.-B. du Halde, *Description géographique, historique, chronologique, politique et physique de la Chine* (Paris, 1735), vol. III, pp. 268–9.
46. F. Verbiest, *Astronomia Europaea sub imperatore Tartaro sinico Cam Hy* (Dillingen, 1687), pp. 75–7. Fr. H. Bosmans (*Documents relatifs à Ferdinand Verbiest*, Bruges, 1912) mentions a letter of Verbiest on the subject of anamorphoses, dated 20 August 1670.
47. For missionaries in China in general, see Fr. P. L. Pfister, *Notes biographiques et bibliographiques sur les Jésuites de l'ancienne mission de la Chine* (Shanghai, 1932).
48. See L. Dalvillé, *Leibnitz historien* (Paris, 1909), p. 88.

CHAPTER TEN: CHINESE PRESTIDIGITATION

1. The Chinese anamorphoses referred to in this chapter belong to the former Georges Salles Collection (six anamorphoses, bought in Peking in 1924), to Mr. C. Ratton (four anamorphoses, one of which belonged to the Salles series) and to Mr. M. Manoukian (three anamorphoses, belonging to a series of eight, acquired in 1929 from Vignier's by Mr. Kelekian). The Salles series is painted on silk, the other two on paper. The dimensions are approximately the same (35 cm. × 30 cm.), so that the same mirror of approximately 4 cm. in diameter can serve for each example.
2. A. Semedo, *Relatione della grande monarchia della China* (Rome, 1643), and *Histoire universelle de la Chine* (Paris, 1645), pp. 107–8.
3. O. Franke, *Keng tschi t'u, Ackerbau und Seidengewinnung in China* (Hamburg, 1913), pp. 80–1.
4. For European contributions to Chinese art, see F. Hirth, *Uber fremde Einflüsse in der chinesische Kunst* (Munich, 1896), pp. 45ff.; B. Laufer, 'Christian Art in China', *Mitteilungen des Seminar für Orientalische Sprachen*, XIII (1910), pp. 110–8; P. Pelliot, 'La peinture et la gravure en Chine au temps de Matthieu Ricci', *T'oung pao*, XX, 1920–1, pp. 1–18 and *Les Influences européennes sur l'art chinois au XVIIe et au XVIIIe siècles, conférence faite au Musée Guimet, 20 février, 1927* (Paris, 1948); R. L. Hobson, *The Later Ceramic Wares of China* (London, 1925), chapter X, pp. 97–103;

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5. F. Hirth, *Chinese Metallic Mirrors* (New York, 1906), reprinted from the Boas Memorial Volume. See also P. Pelliot's account in *T'oung pao*, XX (1920–1), pp. 142–56.
6. The text was published by St Julien ('Notice sur les miroirs magiques des Chinois et leur fabrication', *Comptes rendus des séances de l'Academié des Sciences*, XXIV (1847), pp. 2ff.) who attributes it to Wu Tzu-hsing, identified by P. Pelliot (*T'oung pao*, XX, pp. 1–13) with Wu-ch'iu Yen.
7. M. Govi, 'Les miroirs magiques des Chinois', *Annales de Chimie et de Physique*, vol. 20 (1880), pp. 99–100; A. Bertin, 'Etudes sur les miroirs magiques', *ibid.*, vol. 20 (1881), pp. 472–513; H. Dember, 'Ostasiatische Zauberspiegel', *Ostasiatische Zeitschrift*, N. F., IX (1933), pp. 203–7.
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10. 'Voyages à la chine des P. P. Grueber et d'Orville', in *Relation de divers voyages curieux* (Paris, 1663–72), vol. IV, p. 16.
11. J. Nieuhoff, 'Description de l'empire de la Chine', in *L'Ambassade de la Compagnie Orientale des Provinces Unies vers l'Empereur de Chine* (Leyden, 1665), second part, pp. 33–4.
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13. Victoria and Albert Museum, R. L. Hobson and A. L. Hetherington, *The Art of the Chinese Potter* (London, 1923), pl. CXXXI and S. Jenyns, *Ming Pottery and Porcelain* (London, 1953), fig. 114B.
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15. I am indebted to V. Elisseeff, who has been kind enough to take an interest in this research, for valuable suggestions and friendly cooperation.
16. A. Félibien, *Entretiens sur les vies et sur les ouvrages des plus excellents peintres* (Trévoux, 1725), vol. III, p. 392; see also Y. Picart, *La vie et l'oeuvre de Simon Vouet*, I, *Les jeunes années et le séjour en Italie* (Paris, 1958), p. 11.
17. B. Miller, *Beyond the Sublime Porte, the Grand Seraglio of Stamboul* (New Haven, 1931), p. 106.
18. As opposed to European collections largely composed of K'ang-hi porcelain, there was a preponderance of sixteenth-century Ming porcelain in the collections of the Turkish sultans. The examples could be counted in their thousands. See E. Zimmerman, 'Die Porzellanschätze des Kaiserlichen Schatzhauses und des Museums zu Konstantinopel', *Der Cicerone*, III (1911), pp. 496–503, 'Die Porzellanschätze des alten Serai', *Ostasiatische Zeitschrift*, N. F., IV (1927–8), pp. 134–50 and *Altchinesische Porzellane im alten Serai* (Berlin, 1930). See also R. L. Hobson, 'Chinese Porcelain at Constantinople', followed by observations of Sir Percival David, in the *Transactions of the Oriental Society* (1933–4), p. 18.
19. Madeleine de Scudéry, *Ibrahim ou l'illustre Bassa* (Paris, 1641), p. 422.

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